EDGEXFOUNDRY™

TSC Meeting

July 22, 2020

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Meeting Logistics

Time: Wednesdays 8am PDT – 9am PDT

Join from PC, Mac, Linux, iOS or Android: https://zoom.us/j/983155298

Or iPhone one-tap (US Toll): +14086380968,983155298# or +16465588656,983155298#

Or Telephone:

Dial: +1 408 638 0968 (US Toll) or +1 646 558 8656 (US Toll)

+1 855 880 1246 (US Toll Free)

+1 877 369 0926 (US Toll Free)

Meeting ID: 983 155 298

International numbers available: https://zoom.us/zoomconference?m=mkFexUxEcqHlvXHw53PqScTDRvS48PiQ

** TSC calls are recorded and added to Wiki post-call

TSC – Members Present Today

Company	Name	Email	Position
IOTech	Iain Anderson	iain@iotechsys.com	Device Services WG Chair
Intel	Ernesto Ojeda	ernesto.ojeda@intel.com	Dev Ops WG Chair
IOTech	Keith Steele	keith@iotechsys.com	Outreach WG Chair
Kong	Colin Hutchinson	colin@konghq.com	Security WG Chair
Intel	Mike Johanson	michael.johanson@intel.com	Applications & Analytics WG Chair
IOTech	James Butcher	james@iotechsys.com	Test/QA WG Chair
IOTech	Jim White	jim@iotechsys.com	Core WG Chair

Current quorum = 7 members

Note: Quorum for TSC meetings requires at least fifty percent of all voting members of the TSC to be present. The TSC may continue to meet if quorum is not met, but will be prevented from making any decisions at the meeting. Except as provided in Section 7.c. and 8.a, decisions by vote at a meeting require a majority vote of those in attendance, provided quorum is met. Decisions made by electronic vote without a meeting require a majority vote of all voting members of the TSC.

Today's Agenda

- WG Updates
- TSC Votes
- Multi-file Docker Compose
- China Hackathon Update
- Upcoming Events (Dev Advocate)

Work Group Updates

Chairs

Working Group Chair Updates

- Around the horn
  - Product Manager - Lenny Goodell
  - Release Czar - Lisa Ranjbar
  - Applications - Mike Johanson
  - Device Services - Iain Anderson
  - Test/QA - James Butcher
  - DevOps - Ernesto Ojeda
  - Security - Colin Hutchinson
  - Outreach - Keith Steele
    - Certification - Rodney Hess
    - Marketing - Camilo Dennis
    - Vertical Solutions (and LF Edge TAC) - Henry Lau
  - Core/Supporting - Jim White

Product Manager (7/21/20)

Cross Cutting Issues (https://github.com/orgs/edgexfoundry/projects/35)

In Progress (5)

- V2 Implementations
    - **Good progress on PRs but need others to review**
- Configurable address for ListenAndServe
    - **Individual Device Services with be covered in upcoming dot release**
- Remove Client Monitoring
    - **Individual Device Services with be covered in upcoming dot release**
- Generate/Inject random passwords into Vault
    - ADR PR needs reviewing (https://github.com/edgexfoundry/edgex-docs/issues/132)
    - **Added section for MQTT Message bus**
- Allow device services to be distributed to alternate hosts
    - SSH ADR PR in review (https://github.com/edgexfoundry/edgex-docs/issues/134)
    - **Now pending new edgex-examples repo (Approval TBD)**

Backlog (2)

- Message Bus from Device Service to App Services
- Multiple arch docker images support

Done (2)

- **Refactored Compose files**
- **Remove Support Rules Engine (just from compose files)**

Icebox (4)

- EdgeX Go services move to Go 1.15
- V2 API Consumption
- **Drop Logging Service completely (Revert WIP)**
- **Remove Mongo code (Revert WIP)**
- Update config.Clients usage for new naming scheme
- Explore possible collapse of core command and metadata
- EdgeX Metrics Collection & Control Plane Event Handling

Release Czar (7/15/20)

- Introducing Bill Mahoney from Intel
  - Nominee to take Lisa's place
- ADR 0010 - Release Artifacts
  - https://github.com/edgexfoundry/edgex-docs/pull/165
  - Outlines the current release artifacts and which of them are tied to a code release
  - Tied to Code Release:
    - Docker Images, Docker Compose Files, Snaps, Github Tags, Testing Framework
  - Not tied to Code Release:
    - EdgeX Docs Github Page, Swaggerhub Docs

Applications WG Update (15-July-2020)

WIP:
    Reverted Removal Mongo from App Functions SDK

App Working Group Meeting held on <mark>Thursdays @ 4:30PM PDT</mark>
- Next meeting July 23th, 2020
- Merged w/ Biweekly Rules Engine Meeting

Application Services

Functions (built into SDK)

Current/Complete:

- AES Encryption
- GZIP Compression
- ZLIB Compression
- MarkAsPushed
- PushToCore
- Device Name Filter
- Value Descriptor Filter
- **NEW!** Batch
- **NEW!** JSONLogic Filtering
- XML Conversion
- JSON Conversion
- MQTT(S) Export
- HTTP(S) POST Export

Features

- Store and Forward
- Web Server
- Configurable App Service
- **NEW!** Vault Integration for Secrets
- **NEW!** MQTT Event triggers (via go-mod-messaging)

Reference/Example App Services (Geneva)
(built on top of SDK)

- Azure IoT Hub   **AVAILABLE**

- Amazon IoT Core   **AVAILABLE**

- IBM Watson IoT
- Cloud Event Transformation   **NEW!**
- Secret Retrieval Example

Device Services WG Update (22-Jul-20)

Geneva point release:

- Go SDK updated to v1.2.3
- Most device services ready for re-release
- C SDK update tomorrow

Issue list:

- 24 in backlog (+3)
- 5 new issues (-15)

Next WG meeting July 27

Device Services - current/coming (as of 5/7/20)

Open Source connectors (Current):

- Modbus (TCP/RTU) in Go
- Virtual Device in Go
- SNMP in Go
- MQTT in Go
- BACnet (IP & MSTP) in Go
- ONVIF Cameras in Go
- REST in Go (NEW!)

Open Source connectors (Future):
- Bluetooth in C (summer 2020)
- BACnet (IP & MSTP) in C (summer 2020)
- OPC-UA in C (summer 2020)
- Grove C (summer 2020)

Commercial connectors (Current):

- File Exporter in C
- BLE in C
- Zigbee in C
- GPS in C
- CAN in C
- MEMS in C
- EtherCat in C
- Profinet in C

There are additional commercial MQTT (Go), Modbus (Go), OPC-UA (in C) and BACnet (in C) that have added features over the community editions

Commercial connectors (Future):

- EtherNet/IP in C (summer 2020)
- CanOpen in C (summer 2020)
- OPC-UA Pub/Sub in C (summer 2020)
- ONVIF in C (summer 2020)

Test/QA WG Update (07-14-2020)

- Postman blackbox tests - <u>all passing</u>
  - Working issues
    - Issue #452, update to use new multi-file compose file (in review)
- TAF blackbox tests - <u>all passing</u>
  - Working issues
    - Issue #122, to update to use new multi-file compose file (approved)
    - Issue #134, for loop header ':For' is deprecated on robotframework v3.2.1
    - Issue #130, to modify API path to go through Kong when security is enabled (PR opened)
- New Business
  - Geneva Performance Summary Collection for Dell Gateway 3000, HP MP9, Raspberry Pi3 B+, and Raspberry Pi4
    https://docs.google.com/spreadsheets/d/131AVzDQk0Bq8Y3_NePScoP2PPVzwxYBe2fuztG3jetA/edit#gid=0
  - IOTech will produce an EdgeX branded Geneva performance document containing the above metrics
  - Issue #102, to design how to collect performance metrics data - what and how?

QA/Test WG Update (21st July)

- Postman blackbox test - **all tests passing**
  - Fixed issues
    - Issue #452, update to use new multi-file compose file.
- TAF blackbox test - **all tests passing**
  - Fixed issues
    - Issue #134, for loop header ':For' is deprecated on robotframework v3.2.1.
    - Issue #130, to modify API path to go through Kong when security is enabled.
    - Issue #122, to update to use new multi-file compose file.
    - Issue taf-pipelines#35, pass SECURITY_SERVICE_NEEDED variable for security-enabled tests.
  - Working issues
    - Issue #102, to design how to collect performance metrics data - what and how?
    - Issue #99, to create Core Data v2 API positive test cases
    - Issue #100, to create Core Data v2 API negative test cases
- New Business
  - Performance Metrics Collection for Hanoi (basic)
    https://docs.google.com/presentation/d/1vMeyi7S0i91ILjcAV7ZPxjzlZ5l2dek6g1BNje9HMg0/edit#slide=id.p
  - We will design the long run performance tests for each services (V2 API) and Modbus device scalability test with simulator

Postman Blackbox Test Cases

OS		DB	Total TCs No.	Failed TCs No. of Past Week	Failed TCs No. of This Week	Fixed TCs No.
x86_64 / CentOS	Non Security	Redis	1308	0	0	0
x86_64 / CentOS	Security	Redis	1338	0	0	0
arm64 / Ubuntu	Non Security	Redis	1308	0	0	0
arm64 / Ubuntu	Security	Redis	1338	0	0	0

TAF Functional Blackbox Test Cases

OS		DB	Total TCs No.	Failed TCs No. of Past Week	Failed TCs No. of This Week	Fixed TCs No.
x86_64 / CentOS	Non Security	Redis	52	0	0	0
x86_64 / CentOS	Security	Redis	52	0	0	0
arm64 / Ubuntu	Non Security	Redis	52	0	0	0
arm64 / Ubuntu	Security	Redis	52	0	0	0

TAF Integration Test Cases

Integration tests

OS		DB	Total TCs No.	Failed TCs No. of Past Week	Failed TCs No. of This Week	Fixed TCs No.
x86_64 / CentOS	Non Security	Redis	6	0	0	0
x86_64 / CentOS	Security	Redis	6	0	0	0
arm64 / Ubuntu	Non Security	Redis	6	0	0	0
arm64 / Ubuntu	Security	Redis	6	0	0	0

Compatibility tests

OS		DB	Total TCs No.	Failed TCs No. of Past Week	Failed TCs No. of This Week	Fixed TCs No.
x86_64 / CentOS	Security	Redis	12	0	0	0
arm64 / Ubuntu	Security	Redis	12	0	0	0

DevOps WG Update (07-22-2020)

Hanoi

- **Geneva Snap Mini Release**
  - Effort underway to release edgex-go snap to geneva/edge channel. DevOps will support however needed.
- **Pipeline Enhancements**
  - edgex-go new Jenkins pipeline ready PR-2634
  - Audit DockerHub Images – Will present findings in the next WG meeting #50
  - Multi-Arch docker images added to the backlog (app-service-configurable will be guinea pig) #618
  - Misc python library cleanup to eliminate duplicate code across jobs in cd-management
- **DevSecOps**
  - Vetting of OSS dependencies
    - PDR finalized. Please review here: https://wiki.edgexfoundry.org/pages/viewpage.action?pageId=46760301
- **Other**
  - LF Infra Cost analysis
    - LF global pipeline library ready for use. Will be reviewing for use soon within the existing Jenkins pipelines.

Next DevOps WG Meeting 07/23/2020 @9:00AM PST

Security WG Update (06-17-2020)

- Hanoi release working items in progress/review
  - ADR's still pending
- SIR update
  - No major issues found
- Security WG meeting
  - Proposed changes to the SIR process ([wiki changelog](#))
- Next Meeting: Today & July 29
- Security Board
  - 12 Done (+7)
  - 5 In Review (+1)
  - 1 In Progress (-2)
  - 17 Backlog (+2)
  - 1 New (+1)

Outreach WG Updates (7/22/20)

Certification Team

- An AWS template presented from Ricardo/Intel; polishing on Azure template

Vertical Solutions Team

- 7/28: Jiangxing Intelligence - Prof Jiangchuan Liu, CEO

Marketing Team

- Web site progress

Certification WG Update (6-15-20)

- Determining documentation requirements for the cloud templates
- Discussion on marketing needs for the Endorsement program

- Next meeting is Monday, June 29th, 9 a.m. PDT

Vertical Solutions WG Update (July 14, 2020)

- Kicked off the EdgeX Foundry Adopter Series
  - June 30th Accenture AIP+ adoption of EdgeX
    - Speaker: Allan Haughton, Digital Mobility Mobile IOT and Mobile Security lead
    - 70+ Attendees
  - July 14th Thundersoft, Tuesday 8AM Pacific
    - Speaker: Pengcheng Zou, CTO
  - Jiangxing Intelligence:
    - Speaker: Professor Jiangchuan Liu, CEO

  Register here: https://www.edgexfoundry.org/adopter-series/

Marketing update (7/14/20)

- Continue to drive Website project with El Roboto (3rd party)
  - Folder with key documents milestones and information at the Marketing WG wiki https://wiki.edgexfoundry.org/display/FA/Marketing+WG

Core Working Group (15-Jul-2020)

- V2 API
  - working metadata DTOs & Events controller/handler
  - Addressable removable being explored/tested
- Next call - 7/16/20 @ 10AM US/Central tomorrow
  - V2 API
  - Next steps CLI
  - Requirements for UI
  - Kubernetes next steps

Miscellaneous Issues/Topics

- Looking to appoint an EdgeX Secretary
  - Volunteer role
  - Help with Wiki updates
  - Meeting notes/postings
  - TSC meeting stand in
- Rework of docs continue
- Thundersoft working on RaspPi dev kit and support
- CLI roadmap and moving CLI out of holding
- Jim will be out Aug 7-21

TSC Votes

1. Request TSC approval of the 3rd party package/module review and adoption process.

    https://wiki.edgexfoundry.org/pages/viewpage.action?pageId=46760301

    With thanks to James, Tony, Lenny and others!

2. Request approval of Bill Mahoney of Intel as our new Release Czar (replacing Lisa R)

    Our best wishes and thanks to Lisa on her new chapter

3. edgex-examples repository and rules (per email and Slack - and next slides)
4. Move of CLI out of holding

Example Repository

Proposed Repo Name: edgex-examples

Proposed sub-folders

·   application-services – example application services currently in holding; example app services

·   analytics – examples around rules engine, or other analytics package integration or use

·   device-services – portions of a device service or a device service that would not typically be used in production. Random device service would likely move to examples.

·   deployment – Kubernetes, swarm, etc. deployment and orchestration examples

·   hackathon-projects – projects collected during official EdgeX hackathons (these may be more temporal as they will likely not be maintained)

·   miscellaneous – examples/samples that don't belong in the other folders. Example scripts, makefiles, etc.

·   platform-solutions – examples of getting EdgeX (or a portion of EdgeX) up and running on specific platforms like Raspberry Pi, Arduino

·   product-integration – examples outlining how to integrate with or use EdgeX with other products whether proprietary or open (examples might include ObjectBox, Redis Streams, Foghorn, etc.)

"Rules" (to be placed in a README on the repository)

- Code in the examples will be quickly reviewed by the TSC with each release. Examples will be kept or be removed (because it does not work with the current release, or it is not working with current release and not deemed of any value).

- New folders in the repository must be approved by the TSC

- SDK repositories could contain their own small example or sample code folder to show developers how to use the SDK or SDK feature.

  o Examples include how to create a simple app service or simple device service;

  o Examples may also be included to provide how-to-guide on particular features (how to implement an app function or how to handle automatic / dynamic provisioning).

  o These should remain relatively small so as not to bloat the services created from the SDK.

  o Having the code with the SDK encourages the SDK maintainers to keep these up to date – critical for adoption

  o The goal would be to have automated testing in the future against examples in the SDKs (which is easier to do when the code is in the same repo as the SDK)

- Example code in edgex-examples would be maintained by the project. When it is no longer maintained or used, it will be dropped (archived) from the repository.

- Holding will revert to a "staging" area for code. Examples could be put in holding while it is being reviewed (staged) like other project code, but the goal of it would be to have it eventually approved for move to edgex-examples

- Example code should be minimized in the docs but can/should reference the code in the edgex-examples repo.

- All TSC members are automatically committers to the repository. Any TSC member can request committer rights for another contributor. Like other repositories, it requires the approval of 2 other TSC members.

CLI Roadmap

July 2020
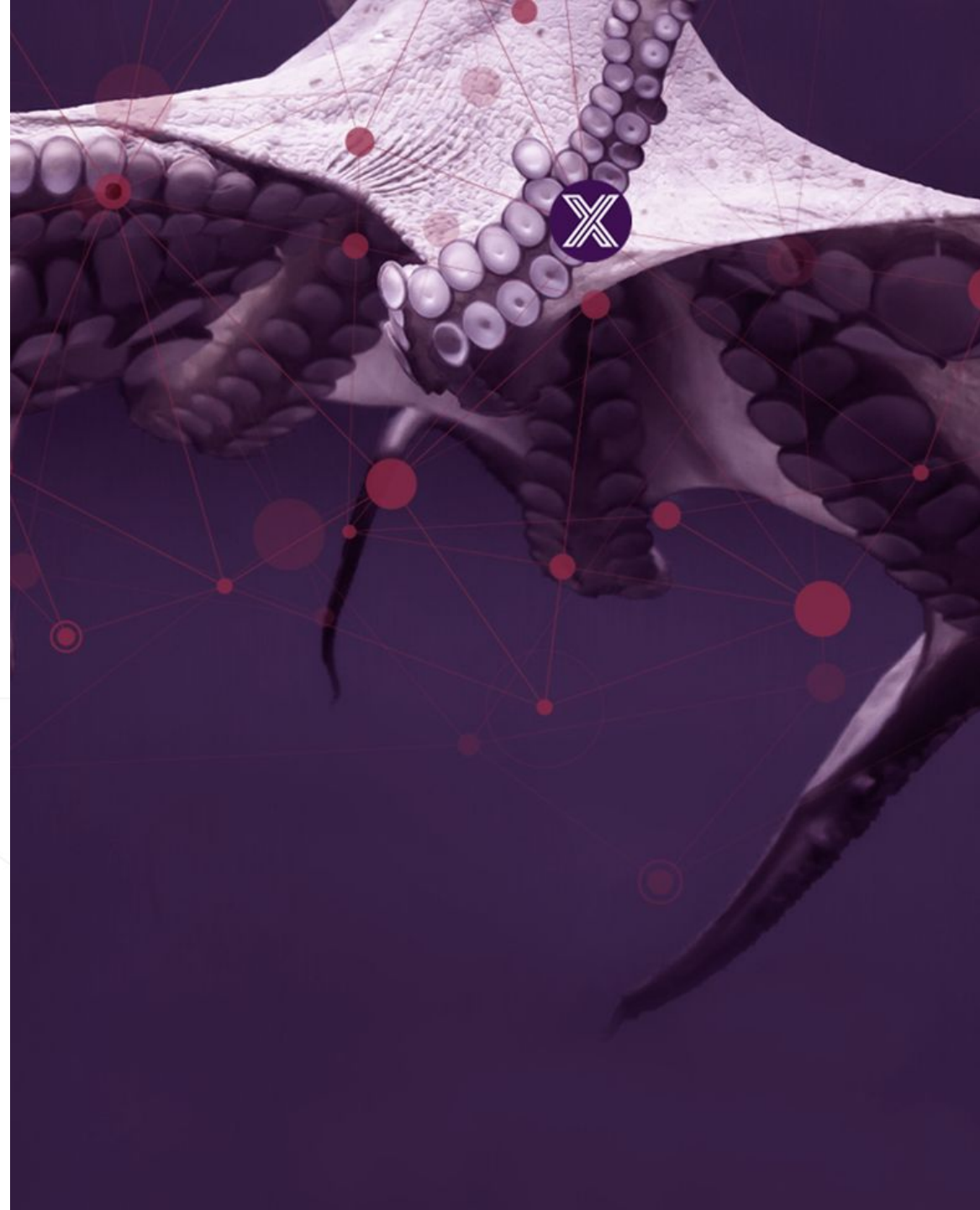
EdgeX-CLI: Purpose and Direction

- Convenience – Easier than using curl or developing custom scripts
  - EdgeX TSC member: "The CLI should allow me to do what I do today with curl" as it relates to EdgeX development
  - Power users savvy with docker and shell might also benefit

- Targets Developers
  - Contributors to EdgeX
  - Adopters looking to customize and extend EdgeX

- The CLI is not "quite" for operators and admins
  - Those working with pre-packaged containers, snaps, etc
  - Does not support secure EdgeX yet

Roadmap targets

- Immediate
  - Priority work item
  - Try to accomplish in next release or two (Hanoi/Ireland)
- Near term
  - Highly desired; moderate lift
  - Within next 3-4 releases (Hanoi/Ireland/Jakarta/Kamakura)
  - May have some dependencies that need addressed first (ex: go-mod-core-contracts)
- Backlog - long term
  - Big lift/need for more resources
    - Parts may be accelerated (crawl steps in crawl, walk run)
  - Lower priority
  - Need EdgeX stability before tackling

Roadmap – Immediate (1-2 releases)

- Keep up with EdgeX releases
  - Hanoi, Ireland
  - Provide for V2 API (along with V1 API until deprecated)

- Develop release strategy and cadence
  - Simplify install (make install)
  - Create container or other artifact
  - Released as part of EdgeX or independently / how versioned
  - Integrating with CI/CD if necessary

- Complete Core service API coverage

- App service & device service integration
  - Ability to add services by configuration
  - Version info
  - API calls
  - Service status

- Show/manage CLI configuration

- Support multiple deletes

- Support JSON for all add operations

- Testing – integrate with TAF

Roadmap – Near Term (3-4 releases out)

- Windows OS support
  - Pagination issues
- Execute Command service commands
- Configurable app service support
  - Modify configuration
- Consul/Registry support
- SMA support/integration
  - Metrics display
  - Service configuration
- Integrate with snap
- Spinner for long running operations
- Link to READMe.md and docs for help and sample files
- Document design and code of CLI

Roadmap - Backlog

- Use CLI in secure mode (with security services/features on)
  - Issue #207
  - Issue #101

- Issue start, stop, restart service operations
  - Call SMA operations for these
  - Requires executors to be running & could be OS dependent
  - May be done via docker compose or other orchestrating technology

- Use with or call on the UI
  - (although the UI could open a terminal and start and EdgeX CLI)

- Handle infrastructure
  - Databases (MongoDB, RedisDB, etc.)
  - Message bus (MQTT Broker, etc.)
  - Existing tools provided by the vendors for these

Current bugs/issues

- Required for move out of holding
  - READMe cleanup
  - Document in edgex-docs #75
    - Copy / format some of the READme to docs

- To-do but not considered show stoppers
  - #235 – remove unnecessary requests for delete
  - #220 – request body not printed on posts (contracts issue)
  - #219 – url not printed (contracts issue)
  - #218 add limit flag (endpoints needed)

Multi-file Docker Compose

Lenny Goodell

Multi-file Compose (The Old Way)

Many Single files (Geneva, Fuji, etc...)

- Copy compose and make changes for specific config
- Simply change images to be ARM64 doubles number of compose files each with 99.9% duplication
- Add security services. Doubles number of compose files each with 60%-80% duplication
- Support two Databases, Doubles number of compose files each with 90% duplication
- Geneva has 8 versions of the main compose file and 2 version of the UI compose file

Most updates require making the same change 8 times

📄	docker-compose-geneva-mongo-arm64.yml
📄	docker-compose-geneva-mongo-no-secty-arm64.yml
📄	docker-compose-geneva-mongo-no-secty.yml
📄	docker-compose-geneva-mongo.yml
📄	docker-compose-geneva-redis-arm64.yml
📄	docker-compose-geneva-redis-no-secty-arm64.yml
📄	docker-compose-geneva-redis-no-secty.yml
📄	docker-compose-geneva-redis.yml
📄	docker-compose-geneva-ui-arm64.yml
📄	docker-compose-geneva-ui.yml

Multi-file Compose (The New Way)

Multiple additive files (Hanoi)

- Uses a **Base** compose file and **Additive** compose files along with **Environment** files (8 files total)
- Much Smaller files
- Eliminates all duplication
- Updates occur only once.
- Only edit **.env** file when creating new release
- More complicated to run when you have to list the Base and each **Additive** compose file.

```
docker-compose -p edgex -f docker-compose-nexus-base.yml \
        -f docker-compose-nexus-add-device-services.yml \
        -f docker-compose-nexus-add-mqtt.yml \
        -f docker-compose-nexus-add-security.yml \
        up -d
```

- Resolved by use of advanced make commands.
  - make run [no-secty] [arm64] [dev]
  - make down
  - etc
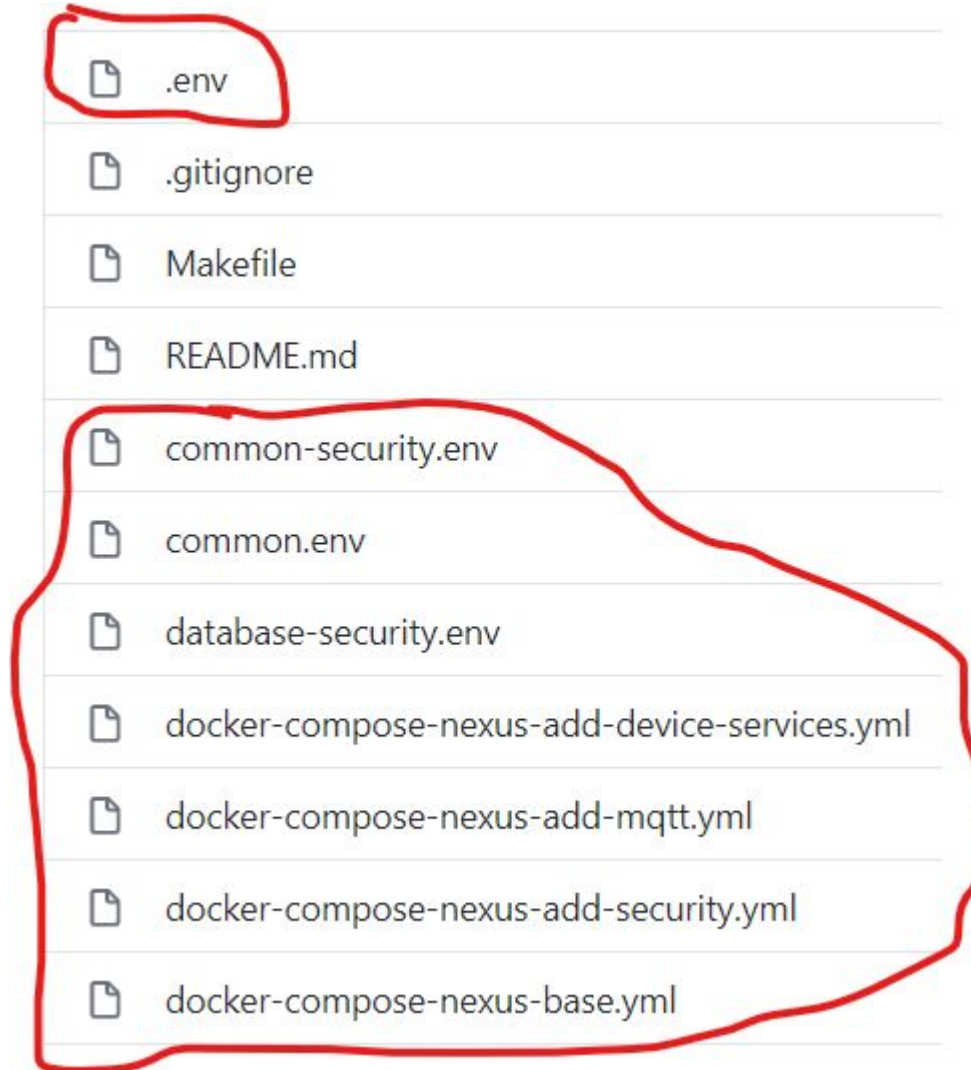
Multi-file Compose (generated all in one files)

But… Still have need for all in one compose files.

- Ease of use (one file to run docker compose on)
- Portability (copy single file to remote system and run it)
- Generated from **source** compose files via **make build** command
- Other make commands for ease of running/stopping
  - make run [no-secty] [arm64]
  - make down
  - etc

See READMEs for complete details.

https://github.com/edgexfoundry/developer-scripts/blob/master/releases/nightly-build/compose-files/README.md

https://github.com/edgexfoundry/developer-scripts/blob/master/releases/nightly-build/compose-files/source/README.md

Now for DEMO

- source
- Makefile
- README.md
- docker-compose-nexus-arm64.yml
- docker-compose-nexus-no-secty-arm64.yml
- docker-compose-nexus-no-secty.yml
- docker-compose-nexus-ui-arm64.yml
- docker-compose-nexus-ui.yml
- docker-compose-nexus.yml

China Hackathon

Thanks Melvin (Intel) & Gavin (VMWare)

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Snapshot of
EdgeX Challenge Shanghai 2020
till Jul 16th

https://wiki.edgexfoundry.org/display/FA/China+Project

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Snapshot
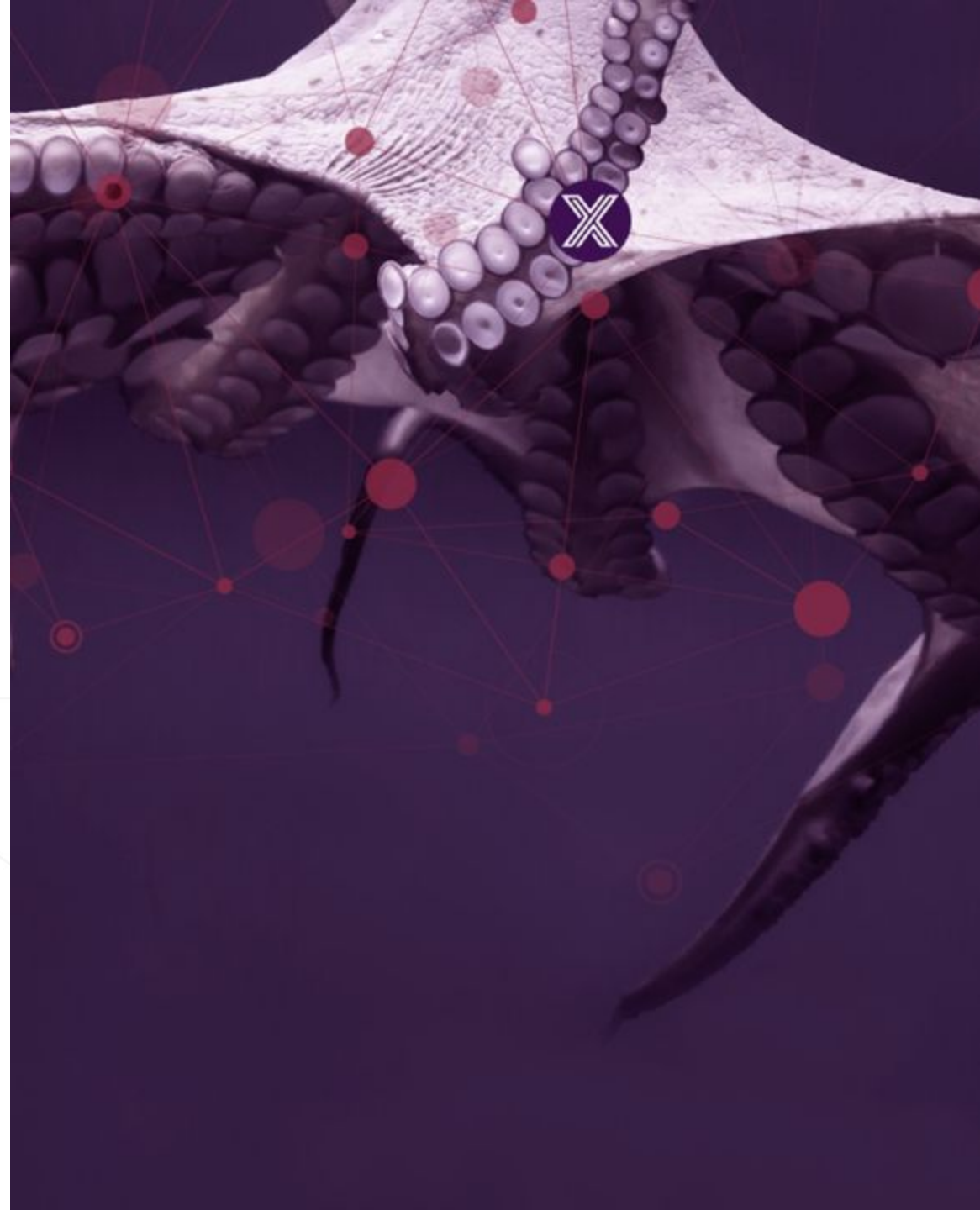
2020. 7. 03-20	2020. 7. 21-24	2020. 7. 25-9. 14	2020. 9. 01-9. 14	2020. 9. 14-25	2020. 9. 24-25	2020. 10
Registration & 1st round proposal submission	1st round evaluation	programing & demo video	2nd round submission	Voting via social media	2nd round evaluation	Award announcement
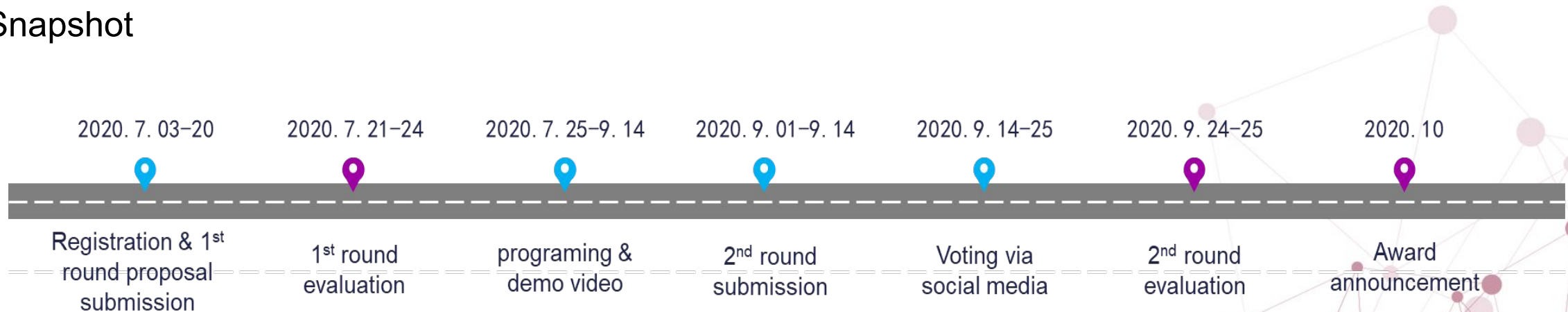
All sessions will be organized online as possible due to COVID-19

Organizations involved

Co-Hosts: LF Edge, STCSM

Sponsors & Co-organizers:
DELL Technologies, HP, Innospace, Intel, IOTech, Tencent, VMware

Two tracks:
- Commerce
- Industrial

Two rounds of contests
- 1st Round: Ideation challenge
- 2nd Round: Demo show-case

About opening ceremony on Jul 3rd
- Keynote speech: LF Edge, sponsors &co-organizers
- Total # of views: 16K

Participations (As of Jul 16th)
- Total # of registrations: 39
- Total # of submissions: 13

Reference links:
- Registration website
- Keynotes video
- Blog announcement

Use-case highlights (As of Jul 16th):
- **Commerce:** weight scale POS, retail store heatmap & monitoring, building automation control, service robot, parking management,…
- **Industrial:** Defects detection for manufacture line, data collection & analytics for oil/gas, industrial gateway, automation commissioning...

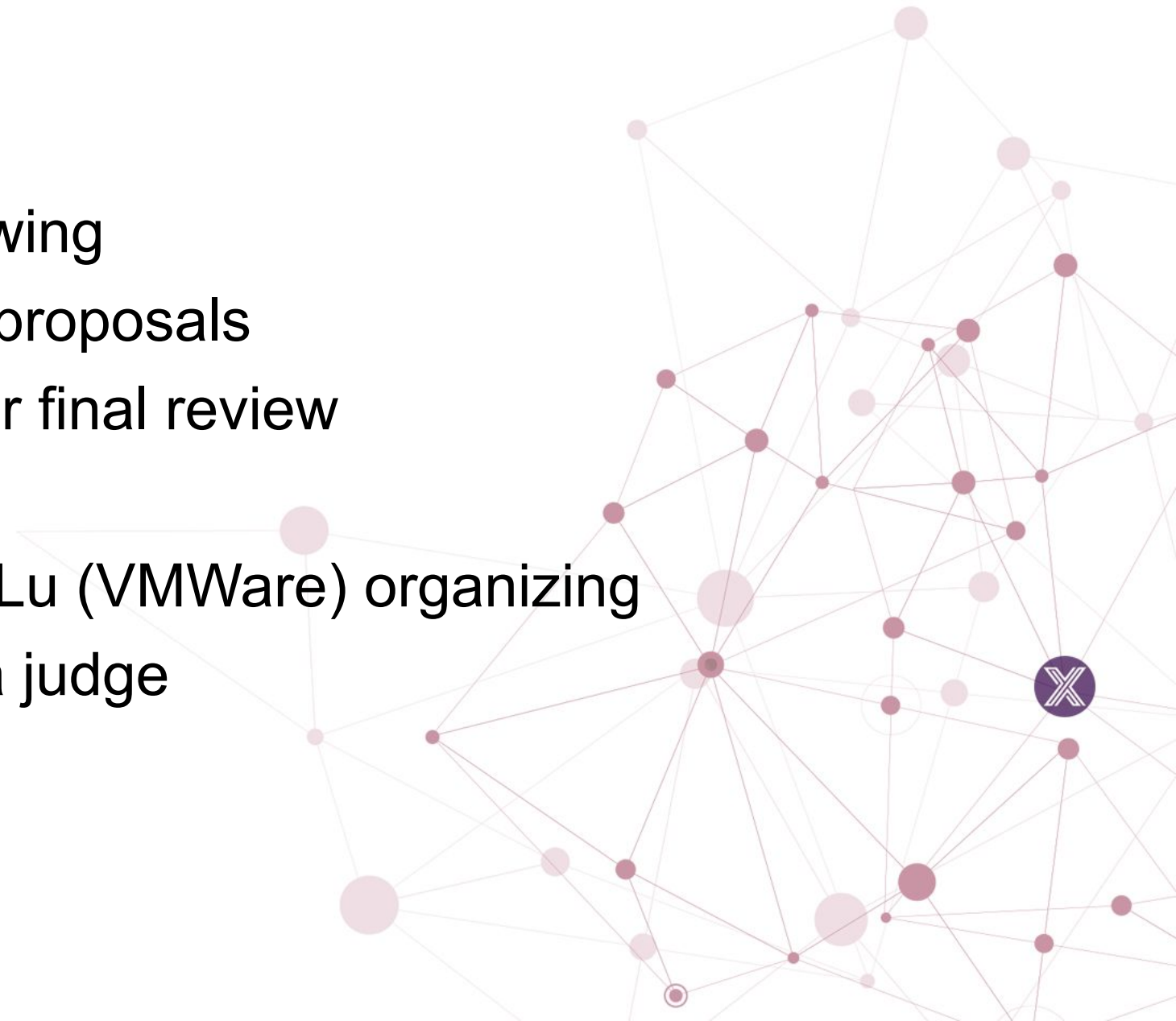edgexfoundry.org | @edgexfoundry

Some stats

16,000+ participants and growing

40+ teams submitted project proposals

 ~20 have been selected for final review

Melvin Sun (Intel) and Gavin Lu (VMWare) organizing

Rocky Jin from Kuiper team a judge

Upcoming Events & Dev Advocate Update

Aaron's updates

Upcoming External Events

› Open Source Summit Japan: 15-16 September, 2020 - Tokyo, Japan
  › CFP Closes July 11:
    https://events.linuxfoundation.org/open-source-summit-japan/program/cfp/
› Open Networking & Edge Summit North America: 28-29 September, 2020 - Virtual
  › ONES Unconference Track
› Open Source Summit Europe: 26-28 October, 2020 - Dublin, Ireland
  › CFP Closes July 26:
    https://events.linuxfoundation.org/open-source-summit-europe/program/cfp/
› KubeCon/CloudNativeCon North America: 17-20 November, 2020 - Boston, MA
› IoT Solutions World Congress: 11-13 May, 2021 - Barcelona, Spain

› Discussions around upcoming events occur in the LF Edge Outreach Committee
› Members may subscribe at: https://lists.lfedge.org/g/outreach-committee

LF Edge Webinar Series

› More to follow...

Upcoming Project Events

› EdgeX Challenge Shanghai 2020
  › Launch Date: July 3rd, 2020
  › Location: Shanghai + Online
  › Organizer: Linux Foundation APAC and Science & Technology Commission (STCSM) of Shanghai Municipal Government
  › Sponsors: Intel, VMware, InnoSpace, Dell Technologies, Thundersoft
  › Supporting Organizations: CCFA (China Chain Store & Franchise Association), Tencent, IOTech
  › Tracks:
    › Commercial (Retail, Hospitality, Banking, Education, etc.）
      › Using EdgeX, based on IOT, AI and data analysis technologies, build innovative applications related to consumer, merchandise, and store.
      › Use EdgeX to build multi-sensor correlated IoT applications.
      › Use EdgeX to build applications beneficial to defeat COVID-19.
      › Combine EdgeX with 5G, blockchain or service robot to build innovative applications
    › Industrial (Factories, Power, Oil/Gas, Utilities）
      › For the multi-edge node scenario, build an SDN + containerized IT solution based on EdgeX
      › In discrete or process (with lower latency requirements) manufacturing, use EdgeX to achieve low latency fault detection and response on the production line
      › In Discrete Manufacturing, use EdgeX to Detect Product Defects Online
      › Using EdgeX to collect data, proceed with energy management of electric/gas/coal/oil, to improve energy efficiency. (Such as: building a thermodynamic model, completing heat meter data collection and automatic valve opening control to optimize heating efficiency)
      › Using EdgeX to realize remote unmanned monitoring of multiple data sources and automatic control of the on-site environment.

Linux Foundation edX Course

› Business Considerations for Edge Computing: https://www.edx.org/course/business-considerations-for-edge-computing

› Official EdgeX Training at LF
› https://training.linuxfoundation.org/training/getting-started-with-edgex-foundry-lfd213/

Thank You

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