

# Technical Advisory Council Meeting

March 12, 2020

 THE **LINUX** FOUNDATION

 LF AI

# Antitrust Policy Notice

- › Linux Foundation meetings involve participation by industry competitors, and it is the intention of the Linux Foundation to conduct all of its activities in accordance with applicable antitrust and competition laws. It is therefore extremely important that attendees adhere to meeting agendas, and be aware of, and not participate in, any activities that are prohibited under applicable US state, federal or foreign antitrust and competition laws.
- › Examples of types of actions that are prohibited at Linux Foundation meetings and in connection with Linux Foundation activities are described in the Linux Foundation Antitrust Policy available at <http://www.linuxfoundation.org/antitrust-policy>. If you have questions about these matters, please contact your company counsel, or if you are a member of the Linux Foundation, feel free to contact Andrew Updegrave of the firm of Gesmer Undergone LLP, which provides legal counsel to the Linux Foundation.

# Recording of Calls

Reminder that TAC calls are recorded and available for viewing on the [TAC Wiki](#)

# Reminder: LF AI Useful Links

Web site: [lfai.foundation](https://lfai.foundation)  
Wiki: [wiki.lfai.foundation](https://wiki.lfai.foundation)  
GitHub: [github.com/lfai](https://github.com/lfai)  
Landscape: [landscape.lfai.foundation](https://landscape.lfai.foundation) or [l.lfai.foundation](https://l.lfai.foundation)  
Mail Lists: <https://lists.lfai.foundation>

LF AI Logos: <https://github.com/lfai/artwork/tree/master/lfai>

LF AI Presentation Template:

[https://drive.google.com/file/d/1eiDNJvXCqSZHT4Zk\\_-czASlz2GTBRZk2/view?usp=sharing](https://drive.google.com/file/d/1eiDNJvXCqSZHT4Zk_-czASlz2GTBRZk2/view?usp=sharing)

Events Page on LF AI Website: <https://lfai.foundation/events/>

Events Calendar on LF AI Wiki (subscribe available):

<https://wiki.lfai.foundation/pages/viewpage.action?pageId=12091544>

Event Wiki Pages: <https://wiki.lfai.foundation/display/DL/LF+AI+Foundation+Events>

# Agenda

- Roll Call
- Approval of Minutes
- Upcoming TAC Chairperson Election
- NNStreamer: Incubation Project Proposal + TAC Vote
- LF AI Updates
- Upcoming TAC Meetings
- Open Discussion

# TAC Voting Members

<b>Member</b>	<b>TAC Contact</b>	<b>TAC Email</b>
Amdocs	Ofer Hermoni*	<a href="mailto:oferher@gmail.com">oferher@gmail.com</a>
AT&T	Jack Murray	<a href="mailto:jfm@research.att.com">jfm@research.att.com</a>
Baidu	Daxiang Dong	<a href="mailto:dongdaxiang@baidu.com">dongdaxiang@baidu.com</a>
Ericsson	Rani Yadav-Ranjan	<a href="mailto:rani.yadav-ranjan@ericsson.com">rani.yadav-ranjan@ericsson.com</a>
Huawei	Huang Zhipeng	<a href="mailto:huangzhipeng@huawei.com">huangzhipeng@huawei.com</a>
Nokia	Pantelis Monogioudis	<a href="mailto:pantelis.monogioudis@nokia.com">pantelis.monogioudis@nokia.com</a>
Tech Mahindra	Nikunj Nirmal	<a href="mailto:nn006444@techmahindra.com">nn006444@techmahindra.com</a>
Tencent	Juniping Du	<a href="mailto:junipingdu@tencent.com">junipingdu@tencent.com</a>
Zilliz	Jun Gu	<a href="mailto:jun.gu@zilliz.com">jun.gu@zilliz.com</a>
ZTE	Wei Meng	<a href="mailto:meng.wei2@zte.com.cn">meng.wei2@zte.com.cn</a>
Acumos AI Project	Anwar Aftab	<a href="mailto:anwar@research.att.com">anwar@research.att.com</a>
Angel Project	Fitz Wang	<a href="mailto:fitzwang@tencent.com">fitzwang@tencent.com</a>
ONNX Project	Prasanth Pulavarthi	<a href="mailto:prasanth.pulavarthi@microsoft.com">prasanth.pulavarthi@microsoft.com</a>

# Approval of Minutes

- › Draft minutes from the February 27th, meeting of the TAC were previously distributed to the TAC members
- › **Proposed Resolution:**
  - › That the minutes of the February 27th meeting of the Technical Advisory Council of the LF AI Foundation are hereby approved

# TAC Chairperson Election

- › The annual TAC Chairperson election will begin in April
- › Please continue to think about any interest in this leadership role
- › Nominations will kick off mid April, followed by voting, and results by end of April
  
- › General TAC and Chairperson details can be viewed within the LF AI Charter under section 7 [here](#) - A summary of the role:
  - › Represent the TAC as a voting member on the Governing Board (will attend monthly meeting)
  - › Lead TAC agenda and meetings with coordination among the TAC representatives and broader community
  - › Attend sync meetings with LF AI staff to discuss overall TAC activities and planning
  - › General representation of the TAC and the LF AI technical community



# Project Contribution Proposal: NNStreamer as an LF AI Incubation Project

# Project Contribution Proposal Review & Discussion: NNStreamer

NNStreamer (Neural Network Support as Gstreamer Plugins) is a set of Gstreamer plugins that allow Gstreamer developers to adopt neural network models easily and efficiently and neural network developers to manage neural network pipelines and their filters easily and efficiently.

**Presenter:** MyungJoo Ham, [myungjoo.ham@samsung.com](mailto:myungjoo.ham@samsung.com)

## Resources:

Github: <https://github.com/nnsuite/nnstreamer>

Project Level: Incubation

Proposal:

<https://github.com/lfaiproject/proposing-projects/blob/052a25042ee145efe883d085fc5019a70c3f6ecf/proposals/nnstreamer.adoc>

# LF AI / NNStreamer 101

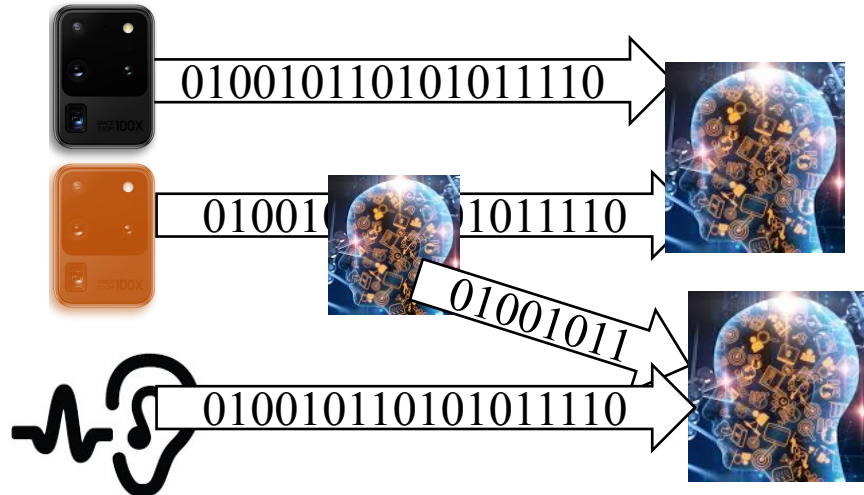
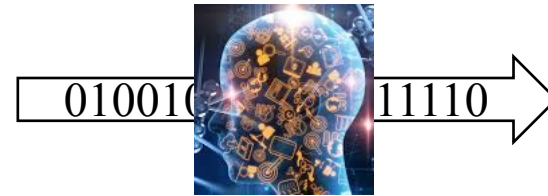
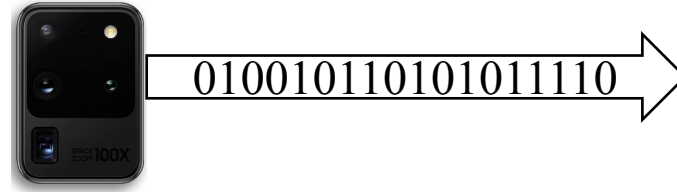
2020.03.12

MyungJoo Ham

<https://github.com/nnsuite/nstreamer>

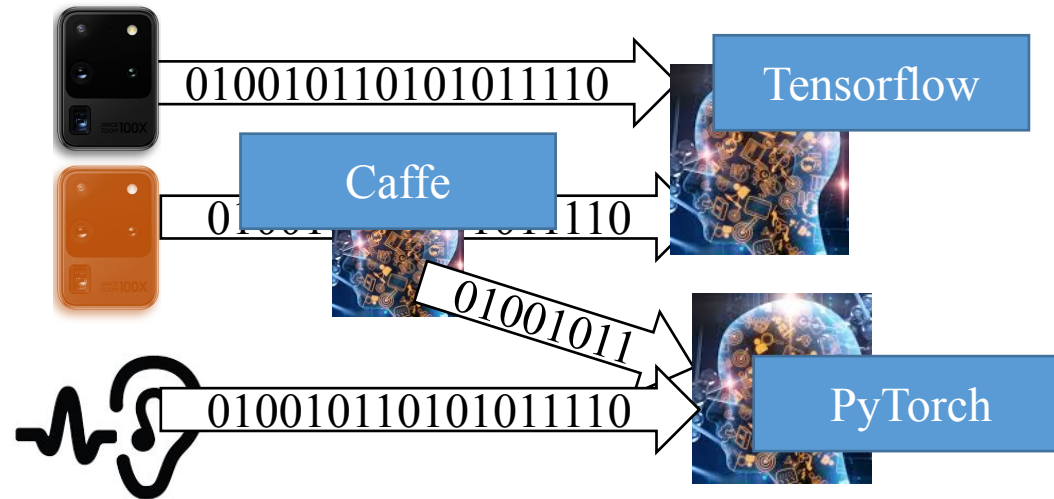
# Why Pipelines?: On-Device AI Systems

- Real-time sensor data
- Real-time processing for streamed data
- Multi-modal and multi-model systems



# Why Pipelines?

- Even in conventional AI systems,
  - Stream pipeline is the “standard” to construct AI services. (Google)
  - Need abstraction for various hardware accelerators and frameworks.



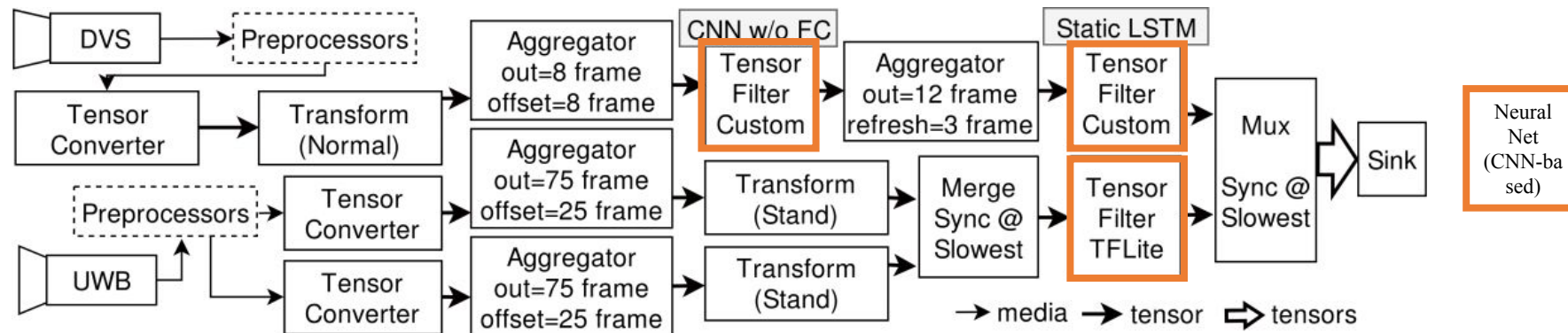


# Why NNStreamer? 2/2

- Reuse “GStreamer” for data stream handling
  - Linux multimedia stream pipelines for 20 years!
  - Product ready!
    - Rich features, high performance, reliable
    - Fast prototyping, cross-platform/languages
  - Reuse hundreds of Gstreamer plugins!

# NNStreamer Introduction

- Allow to construct pipelines with Neural Networks as filters



- Conventional: > 1000 LoC / NNStreamer: < 20 LoC
- Highly efficient:
  - > 4 MM, 90% CPU, 40MB RAM vs
  - < 0.25 MM, 50% CPU, 17MB RAM



# Comparison with Similar Systems

	NNStreamer	DeepStream	MediaPipe
First Released	2018	2018	2019
Pipeline Framework	GStreamer	GStreamer	In-house
License	LGPL-2.1	Proprietary (Partially Apache-2.0)	Apache-2.0
SCM (git history)	Opened	Proprietary	Hidden
Tensor Data	First class type	“metadata” of conventional media (video/audio/text)	First class type
Supported Devices	Primary Target: Embedded devices  Tizen, Ubuntu, Android, Yocto, macOS	Nvidia devices only	Primary Target: Cloud/servers  Not so ready for embedded.

# Features as GStreamer Plugins

- Format Conversion
  - To Tensors: video, audio, text, arbitrary binary
  - From Tensors: video (box, label, segmentation), text (classification)
- Filters
  - TF-Lite (1.09-1.15), TF (1.09-1.15), Caffe2, PyTorch, NN-Runtime, SNAP
  - Edge-TPU, Movidius-X (NCSDK2, OpenVINO), ARMNN, ... (more)
  - C functions, Python functions, C++ classes
- Connectors
  - Tensor Source (stream input): ROS, Tizen Sensor F/W, Linux IIO
  - Tensor Sink (stream output): ROS
- Path/Data Manipulators
  - Merge, Split, Mux, Demux, Aggregator, Repo-src/sink (stream loops), Transform, ...

# NNStreamer in Samsung

- Tizen Machine Learning Framework == NNStreamer

- Tizen Products with NNStreamer

- TVs ( ~ 40 millions / year, future products )
- Wearable products (2020 updates)
- Speakers (2020 updates)
- Home appliances (future products)



- Android NNStreamer APIs (mobile products)

- Released via JCenter for third party developers.
- Equivalent with Tizen ML APIs



# NNStreamer Contributors

- Full-time “employed” contributors.

- MyungJoo Ham (2018.3. ~)      Ji Joong Moon (2018.5. ~)
- Geunsik Lim (2018.6. ~)      Wook Song (2018.6. ~)
- Hyoung Joo Ahn (2018.7. ~)      Jaeyun Jung (2018.8. ~)
- Sangjung Woo (2018.8. ~)      Parichay Kapoor (2019.2. ~)
- Dongju Chae (2019.3. ~)      Gichan Jang (2019.10. ~)
- Yongjoo Ahn (2020.1. ~)

- NNStreamer status in Samsung:

- NNStreamer is the Machine-Learning backbone (API and framework) of Tizen, maintained by Samsung since 2012.
  - NNStreamer founder = Tizen Machine Learning domain architect.
- NNStreamer is adopted for wide-ranges of Samsung products, extending to Android products, too.

# Roadmap

- Standard C++ class for adaptation layer (2020.4.)
- .NET/C# Pipeline API for Tizen Products (2020.5.)
- GPU/NPU memcpy-less pipelining (2020-Q2)
- On-Device Training Framework (2020-Q3)
- Support “IF statement” in stream filters. (2020-Q3)
- More H/W adaptation & framework support (2020)
  - Verisilicon-Vivante, Qualcomm-NPU/DSP, Exynos-NPU, ...
- Inter-pipeline cooperability. (data serialization & standardization)
  - Protobuf/Flatbuf (2020)
  - Connection with MediaPipe/DeepStream (2021)
- Distributed “Edge-AI” (2021)

# Other Repos in [github.com/nnsuite/](https://github.com/nnsuite/)

- **TAOS-CI:** per-PR code verification & quality-assurance service.
  - Used by nnsreamer and other projects in Samsung
- **nnsreamer-ros:** ROS nodes for NNStreamer pipelines
- **nnsreamer-example:** NNStreamer example apps.
- **meta-neural-network:** Yocto/OpenEmbedded layer.
- **nnsreamer-edge:** (Planned) remote input stream source for lightweight devices (systems w/o gstreamer)
- **Forked repos:** repackaged open source projects for redistributions in Launchpad/PPA and Tizen/OBS.

# Additional Materials

- 2018.10. GStreamer Conference: [[video](#)] [[slides](#)]
- 2019.1. Tech Report: <https://arxiv.org/abs/1901.04985>
  - 2020 Tech Report: (WIP)
- 2019.10. Samsung Developer Conference: [[video](#)]
- Tizen API: [5.5 [Native API](#)] [5.5 [.NET API](#)]
- Android Studio: [JCenter release](#)
- Ubuntu PPA: [ppa:nnstreamer/ppa](#)
- Yocto OpenEmbedded: [[Neural Network Layer](#)]
- MacOS: [[Brew Tap](#)]

# GitHub Incubation Proposal

<https://github.com/lfai/proposing-projects/blob/052a25042ee145efe883d085fc5019a70c3f6ecf/proposals/nstreamer.adoc>



# Questions/Discussion

# TAC Vote on Project Proposal

## **Proposed Resolution:**

The TAC approves the NNStreamer Project as an Incubation project of the LF AI Foundation

# Next Steps

Work with the NNStreamer project on an announcement and onboarding

Explore potential integrations between this project and other LF AI projects

# LF AI Updates

# Outreach Committee

# Recent Announcements

1. **New Member Welcome - RStudio + inwinSTACK + ISSIP:**  
<https://lfai.foundation/blog/2020/01/30/lf-ai-foundation-new-member-welcome-rstudio-inwinstack-issip/>
2. **Sparklyr New Project:**  
<https://lfai.foundation/blog/2020/01/29/sparklyr-joins-lf-ai-as-its-newest-incubation-project/>
3. **LF AI 2019 Year in Review:**  
<https://lfai.foundation/blog/2020/01/22/lf-ai-2019-year-in-review/>
4. **Horovod 0.19.0 Release:**  
<https://lfai.foundation/blog/2020/01/14/horovod-version-0-19-0-now-available/>
5. **Angel Graduation:**  
<https://lfai.foundation/blog/2019/12/19/lf-ai-foundation-announces-graduation-of-angel-project/>
6. **Zilliz new premier member:**  
<https://lfai.foundation/blog/2019/12/17/lf-ai-welcomes-zilliz/>
7. **LF AI Day Shanghai Summary:**  
<https://lfai.foundation/blog/2019/12/05/thank-you-lf-ai-day-shanghai-summary/>
8. **LF AI Receives Contribution Award from CAAI:**  
<https://lfai.foundation/blog/2019/11/27/lf-ai-receives-best-contribution-award/>
9. **Acumos Clio Release:**  
<https://lfai.foundation/press-release/2019/11/26/lf-ai-delivers-acumos-ai-clio-release/>
10. **Pyro 1.0.0 Release:** <https://lfai.foundation/blog/2019/11/18/pyro-1-0-has-arrived/>

# Upcoming Announcements

## March:

Marquez New Project  
Milvus New Project  
ITU Global Challenge on AI/ML in 5G Networks Promotion  
IEEE Infrastructure Conference - LF AI Participation  
Acumos and Angel Collaboration  
LF AI 2 Year Anniversary

## April:

Angel Roadmap + Project Participation Invite  
Q2 New Member Announcements  
IEEE Infrastructure Conference - Event Summary

# LF AI Events

**Event Leads Needed - Please Encourage Member Participation Across Your Organizations**

Events Page on LF AI Website:

<https://lfai.foundation/events/>

Events Calendar on LF AI Wiki (subscribe available):

<https://wiki.lfai.foundation/pages/viewpage.action?pageId=12091544>

2020 Events Wiki:

<https://wiki.lfai.foundation/display/DL/2020+Events>

**The [Outreach Committee](#) and LF AI Community need to identify Event Leads to drive these events as the Foundation is not resources/budgeted to manage them all. Please encourage participation within your organizations. LF AI provides [event planning templates/resources](#) and is available to help with guidance and questions along the way. Please email the Jessica Kim (Outreach Committee Chair) or Jacqueline/Ibrahim to discuss participation.**

# Call to Participate in Ongoing Efforts



# Trusted AI

- › **Leadership:**  
Animesh Singh (IBM), Souad Ouali (Orange), and Jeff Cao (Tencent)
- › **Goal:** Create policies, guidelines, tooling and use cases by industry
- › **Github:**  
<https://github.com/lfai/trusted-ai>
- › **Wiki:**  
<https://wiki.lfai.foundation/display/DL/Trusted+AI+Committee>
- › **To participate:**  
<https://lists.lfai.foundation/g/trustedai-committee/>
- › **Next call:** Bi-weekly on Thursdays at 7am PT, subscribe to group calendar on wiki  
<https://wiki.lfai.foundation/pages/viewpage.action?pageId=12091895>

# ML Workflow

- › **Leadership:**  
Ofer Hermoni
- › **Goal:**  
Define an ML Workflow and promote cross project integration
- › **Wiki:**  
<https://wiki.lfai.foundation/display/DL/ML+Workflow+Committee>
- › **To participate:**  
<https://lists.lfai.foundation/g/mlworkflow-committee>
- › **Next call:** Every 4 weeks on Thursdays at 7:00 am PT, subscribe to group calendar on wiki  
<https://wiki.lfai.foundation/pages/viewpage.action?pageId=18481242>

# Upcoming TAC Meetings

# Upcoming TAC Meetings

**March 26:** ForestFlow (Dreamworks) Proposal + TAC Vote

**April 9:** Open Data Hub Introduction + TAC Chair Election Kickoff

# TAC Meeting Details

- › To subscribe to the TAC Group Calendar, visit the wiki: <https://wiki.lfai.foundation/x/XQB2>
- › Join from PC, Mac, Linux, iOS or Android: <https://zoom.us/j/430697670>
- › Or iPhone one-tap:
  - › US: +16465588656,,430697670# or +16699006833,,430697670#
- › Or Telephone:
  - › Dial(for higher quality, dial a number based on your current location):
  - › US: +1 646 558 8656 or +1 669 900 6833 or +1 855 880 1246 (Toll Free) or +1 877 369 0926 (Toll Free)
- › Meeting ID: 430 697 670
- › International numbers available: <https://zoom.us/u/achYtcw7uN>

# Open Discussion

# Legal Notices

- › The Linux Foundation, The Linux Foundation logos, and other marks that may be used herein are owned by The Linux Foundation or its affiliated entities, and are subject to The Linux Foundation's Trademark Usage Policy at <https://www.linuxfoundation.org/trademark-usage>, as may be modified from time to time.
- › Linux is a registered trademark of Linus Torvalds. Please see the Linux Mark Institute's trademark usage page at <https://lmi.linuxfoundation.org> for details regarding use of this trademark.
- › Some marks that may be used herein are owned by projects operating as separately incorporated entities managed by The Linux Foundation, and have their own trademarks, policies and usage guidelines.
- › TWITTER, TWEET, RETWEET and the Twitter logo are trademarks of Twitter, Inc. or its affiliates.
- › Facebook and the "f" logo are trademarks of Facebook or its affiliates.
- › LinkedIn, the LinkedIn logo, the IN logo and InMail are registered trademarks or trademarks of LinkedIn Corporation and its affiliates in the United States and/or other countries.
- › YouTube and the YouTube icon are trademarks of YouTube or its affiliates.
- › All other trademarks are the property of their respective owners. Use of such marks herein does not represent affiliation with or authorization, sponsorship or approval by such owners unless otherwise expressly specified.
- › The Linux Foundation is subject to other policies, including without limitation its Privacy Policy at <https://www.linuxfoundation.org/privacy> and its Antitrust Policy at <https://www.linuxfoundation.org/antitrust-policy>, each as may be modified from time to time. More information about The Linux Foundation's policies is available at <https://www.linuxfoundation.org>.
- › Please email [legal@linuxfoundation.org](mailto:legal@linuxfoundation.org) with any questions about The Linux Foundation's policies or the notices set forth on this slide.