



INDIAN INSTITUTE OF
INFORMATION
TECHNOLOGY

Big Data Analytics and Ubiquitous Computing

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Big Data Analytics

❑ Big Data Analytics

1. Big Data
2. Spark: Big Data Analytics
3. Resilient Distributed Datasets (RDD)
4. Spark libraries (SQL, DataFrames, MLlib for machine learning, GraphX, and Streaming)
5. PFP: Parallel FP-Growth

❑ Ubiquitous Computing

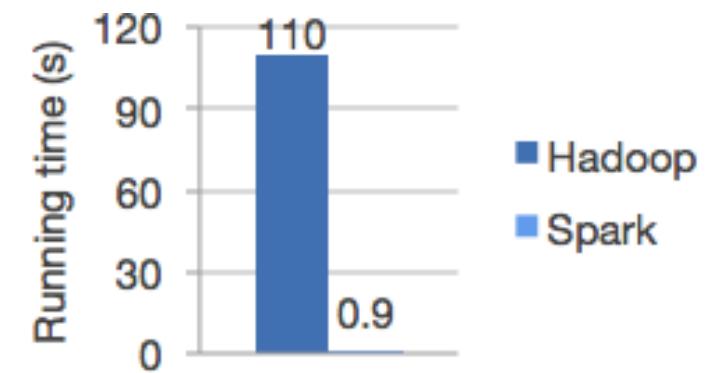
Big Data

- Big data can be described by the following characteristics:
 - Volume: size large than terabytes and petabytes
 - Variety: type and nature, structured, semi-structured or unstructured
 - Velocity: speed of generation and processing to meet the demands
 - Veracity: the data quality and the data value
 - Value: Useful or not useful
- The main components and ecosystem of Big Data
 - Data Analytics: data mining, machine learning and natural language processing
 - Technologies: Business Intelligence, Cloud computing & Databases
 - Visualization: Charts, Graphs etc.



Apache Spark

- Unified analytics engine for large-scale data processing.
- Speed: Run workloads 100x faster.
- Both batch and streaming data, using Directed Acyclic Graph (DAG) scheduler, a query optimizer, and a physical execution engine.
- Ease of Use: Write applications quickly in Java, Scala, Python, R, and SQL.
- Spark offers 80+ high-level operators to build parallel apps.



Spark: Unified Big Data Analytics

- New applications of Big data workloads on Unified Engine of
 - Streaming, Batch, and Interactive.
- Composability in programming libraries for big data and encourages development of interoperable libraries
- Combining the SQL, machine learning, and streaming libraries in Spark

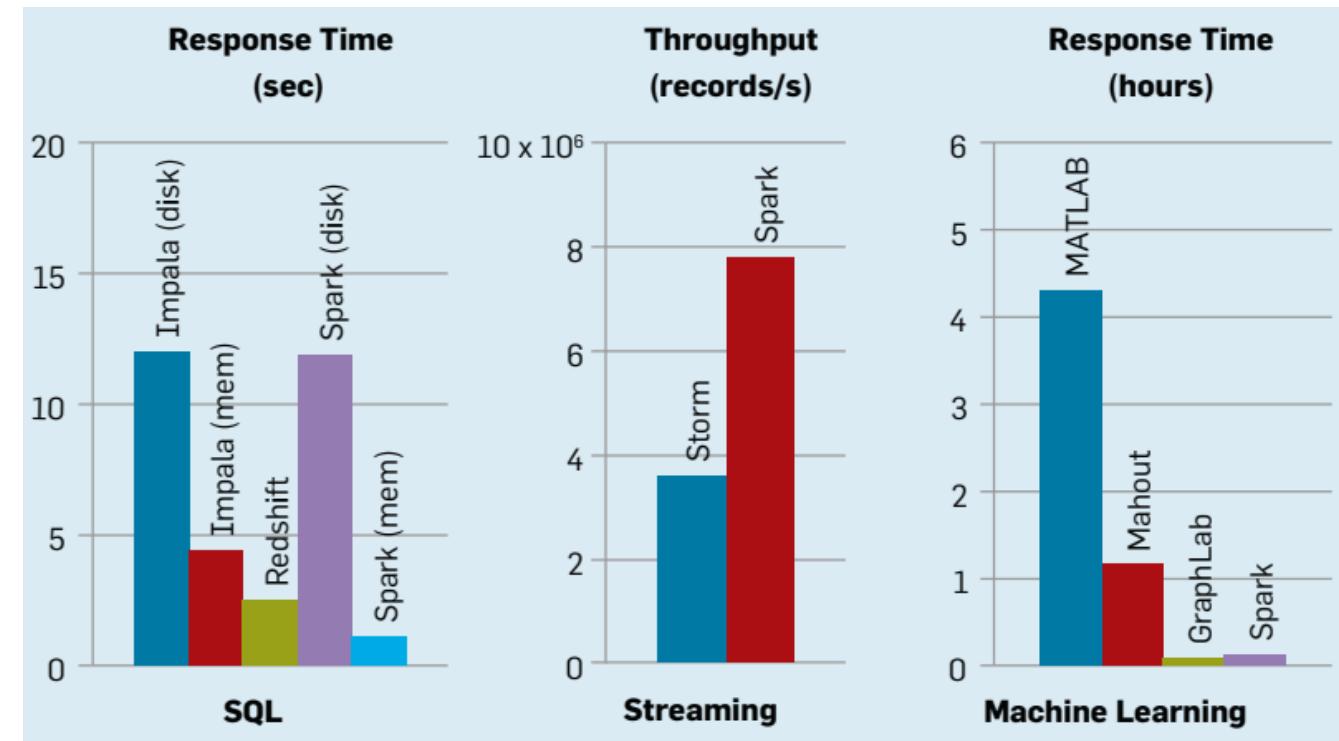
```
// Load historical data as an RDD using Spark SQL
val trainingData = sql(
    "SELECT location, language FROM old_tweets")

// Train a K-means model using MLlib
val model = new KMeans()
    .setFeaturesCol("location")
    .setPredictionCol("language")
    .fit(trainingData)
// Apply the model to new tweets in a stream
TwitterUtils.createStream(...)
    .map(tweet => model.predict(tweet.location))
```

Zaharia, Matei, et al. "Apache spark: a unified engine for big data processing." *Communications of the ACM* 59.11 (2016): 56-65.

Spark: Unified Big Data Analytics

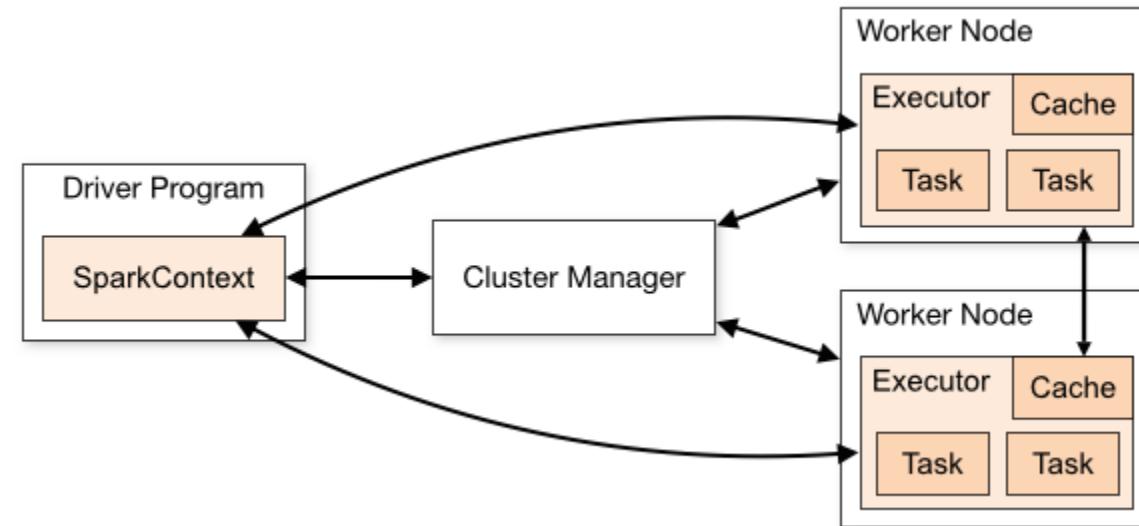
- Spark has MapReduce programming model with extended data-sharing abstraction called “Resilient Distributed Datasets,” or RDDs.



Zaharia, Matei, et al. "Apache spark: a unified engine for big data processing." *Communications of the ACM* 59.11 (2016): 56-65.

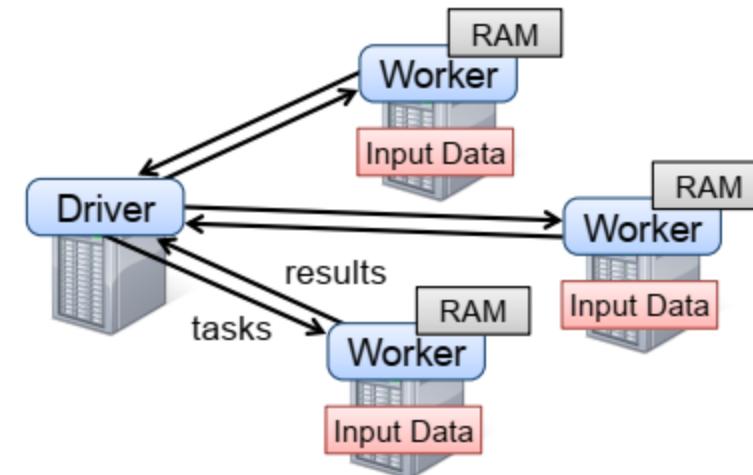
Spark Architecture

- Spark works on the popular Master-Slave architecture.
- Cluster works with a single master and multiple slaves.
- The Spark architecture depends upon two abstractions:
 - Resilient Distributed Dataset (RDD)
 - Directed Acyclic Graph (DAG)



Resilient Distributed Datasets (RDD)

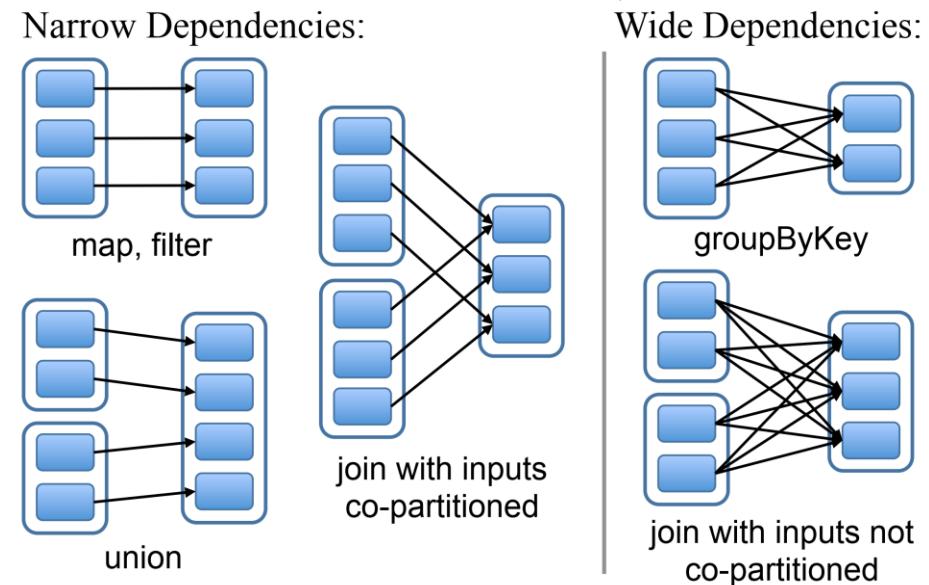
- A distributed memory abstraction: perform in-memory computations on large clusters
- Keeping data in memory can improve performance
- Spark runtime: Driver program launches multiple workers that read data blocks from a distributed file system and can persist computed RDD partitions in memory.



Zaharia, Matei, et al. "Resilient distributed datasets: A fault-tolerant abstraction for in-memory cluster computing." *Presented as part of the 9th {USENIX} Symposium on Networked Systems Design and Implementation ({NSDI} 12)*. 2012.

Resilient Distributed Datasets (RDD)

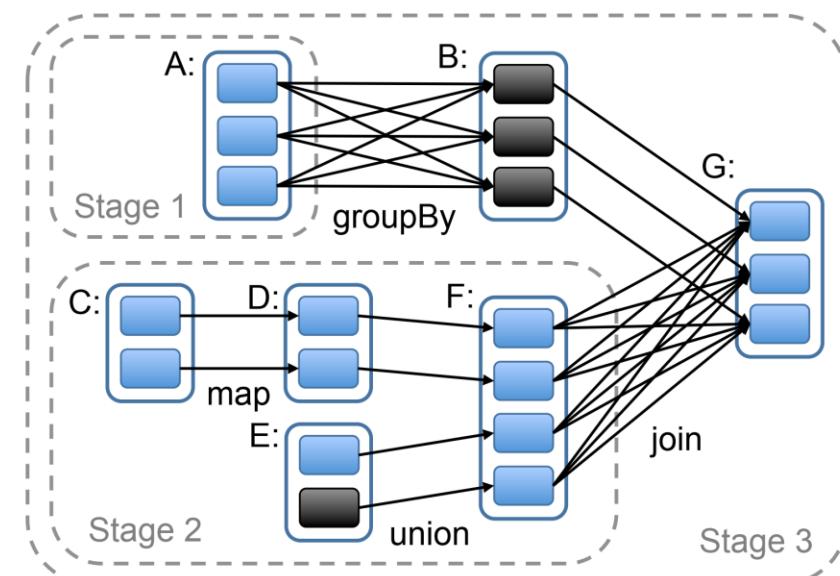
- Each box is an RDD, with partitions as shaded rectangles.
- *narrow* dependencies, where each partition of the parent RDD is used by at most one partition of the child RDD,
- *wide* dependencies, where multiple child partitions may depend on it.



Zaharia, Matei, et al. "Resilient distributed datasets: A fault-tolerant abstraction for in-memory cluster computing." *Presented as part of the 9th {USENIX} Symposium on Networked Systems Design and Implementation ({NSDI} 12)*. 2012.

Resilient Distributed Datasets (RDD)

- Direct Acyclic Graph (DAG) to perform a sequence of computations
- Each node is an RDD partition,
- Run an action (*e.g.*, *count* or *save*) on an RDD, the scheduler examines that RDD's lineage graph to build a DAG of *stages* to execute.
- Each stage contains with narrow dependencies
- The boundaries of the stages are the shuffle operations required for wide dependencies.
- Scheduler computes missing partitions until it computed RDD.



Zaharia, Matei, et al. "Resilient distributed datasets: A fault-tolerant abstraction for in-memory cluster computing." *Presented as part of the 9th {USENIX} Symposium on Networked Systems Design and Implementation ({NSDI} 12)*. 2012.

Apache Spark



- Combine SQL, streaming, and complex analytics. Spark libraries
 - [SQL and DataFrames](#),
 - [MLlib](#) for machine learning,
 - [GraphX](#), and
 - [Spark Streaming](#).
- Spark runs on Hadoop, Apache Mesos, Kubernetes, standalone, or in the cloud.
- Run Spark using its [standalone cluster mode](#), on [EC2](#), on [Hadoop YARN](#), on [Mesos](#), or on [Kubernetes](#).
- Access data in [HDFS](#), [Alluxio](#), [Apache Cassandra](#), [Apache HBase](#), [Apache Hive](#), and hundreds of other data sources.



Spark Code Example

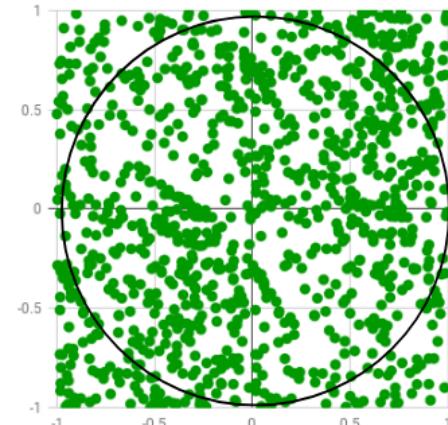
- Word Count

```
JavaRDD<String> textFile = sc.textFile("hdfs://...");  
JavaPairRDD<String, Integer> counts = textFile  
    .flatMap(s -> Arrays.asList(s.split(" ")).iterator())  
    .mapToPair(word -> new Tuple2<>(word, 1))  
    .reduceByKey((a, b) -> a + b);  
counts.saveAsTextFile("hdfs://...");
```

- Pi Estimation

```
List<Integer> l = new ArrayList<>(NUM_SAMPLES);  
for (int i = 0; i < NUM_SAMPLES; i++) {  
    l.add(i);  
}  
  
long count = sc.parallelize(l).filter(i -> {  
    double x = Math.random();  
    double y = Math.random();  
    return x*x + y*y < 1;  
}).count();  
System.out.println("Pi is roughly " + 4.0 * count / NUM_SAMPLES);
```

$$\text{Pi} = 4 \times \frac{\text{number of random point inside the circle}}{\text{number of random point inside the square}}$$





Spark SQL

- Working with structured data.
- Integrated: SQL queries with Spark programs.

```
results = spark.sql("SELECT * FROM people")
names = results.map(lambda p: p.name)
```

Apply functions to results of SQL queries.

- Uniform Data Access: Connect to data sources, including Hive, Avro, Parquet, ORC, JSON, and JDBC.

```
spark.read.json("s3n://...").registerTempTable("json")
results = spark.sql("""SELECT * FROM people JOIN json ...""")
```

- Query and join different data sources
- Hive Integration Spark HiveQL
- Standard Connectivity: Connect through JDBC or ODBC.
- Business intelligence tools to query big data.



DataFrame API Examples

- Collection of data organized into named columns
- Use DataFrame API to perform various relational operations
- Automatically optimized by Spark's built-in optimizer

```
// Creates a DataFrame having a single column named "line"
JavaRDD<String> textFile = sc.textFile("hdfs://.../");
JavaRDD<Row> rowRDD = textFile.map(RowFactory::create);
List<StructField> fields = Arrays.asList(
    DataTypes.createStructField("line", DataTypes.StringType, true));
StructType schema = DataTypes.createStructType(fields);
DataFrame df = sqlContext.createDataFrame(rowRDD, schema);

DataFrame errors = df.filter(col("line").like("%ERROR%"));
// Counts all the errors
errors.count();
// Counts errors mentioning MySQL
errors.filter(col("line").like("%MySQL%")).count();
// Fetches the MySQL errors as an array of strings
errors.filter(col("line").like("%MySQL%")).collect();
```



Spark Streaming

- Build scalable fault-tolerant streaming applications.
- Write streaming jobs -- Same Way -- Write batch jobs
 - Counting tweets on a sliding window

```
TwitterUtils.createStream(...)  
.filter(_.getText.contains("Spark"))  
.countByWindow(Seconds(5))
```

- Reuse the same code for batch processing
 - Find words with higher frequency than historic data:

```
stream.join(historicCounts).filter {  
  case (word, (curCount, oldCount)) =>  
    curCount > oldCount  
}
```

Batch processing takes N unit time to process M unit of data

Batch processing takes N+x unit time to process M+y unit of data

Stream processing takes N unit time to process M unit of data

Stream processing takes x unit time to process M+y unit of data



Spark GraphX

- Spark's API for graphs and graph-parallel computation

```
graph = Graph(vertices, edges)
messages = spark.textFile("hdfs://...")
graph2 = graph.joinVertices(messages) {
    (id, vertex, msg) => ...
}
```

- Fast Speed for graph algorithms
- GraphX graph algorithms
 - PageRank
 - Connected components
 - Label propagation
 - SVD++
 - Strongly connected components
 - Triangle count



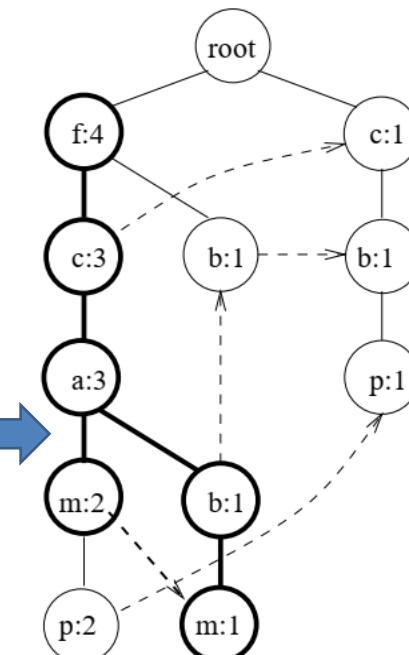
Spark MLlib

- Spark's scalable machine learning library
- Spark MLlib algorithms
 - Classification: logistic regression, naive Bayes,...
 - Regression: generalized linear regression, survival regression,...
 - Decision trees, Random forests, and Gradient-boosted trees
 - Recommendation: Alternating Least Squares (ALS)
 - Clustering: K-means, Gaussian mixtures (GMMs),...
 - Topic modeling: Latent Dirichlet Allocation (LDA)
 - **Frequent itemsets, Association rules, and Sequential pattern mining**

FP-Growth for recommendation

- “FP” stands for Frequent Pattern in a Dataset of transactions
 1. calculate item frequencies and identify frequent items,
 2. a suffix tree (FP-tree) structure to encode transactions, and
 3. frequent itemsets can be extracted from the FP-tree.
- Input: Transaction database
- Intermediate Output: FP-Tree
- Output: $\{f, c, a \rightarrow a, m, p\}$, $\{f, c, a \rightarrow b, m\}$

TID	Items Bought	(Ordered) Frequent Items
100	f, a, c, d, g, i, m, p	f, c, a, m, p
200	a, b, c, f, l, m, o	f, c, a, b, m
300	b, f, h, j, o	f, b
400	b, c, k, s, p	c, b, p
500	a, f, c, e, l, p, m, n	f, c, a, m, p



Han Jiawei, Jian Pei, and Yiwen Yin. "Mining frequent patterns without candidate generation." *ACM SIGMOD Record* 29.2 (2000): 1-12.

PFP: Parallel FP-Growth

- In Spark ML-Library (MLLib), a parallel version of FP-growth called PFP: Parallel FP-Growth
- PFP distributes the work of growing FP-trees based on the suffixes of transactions.
- More scalable than a single-machine implementation.
- PFP partitions computation, where each machine executes an independent group of mining tasks

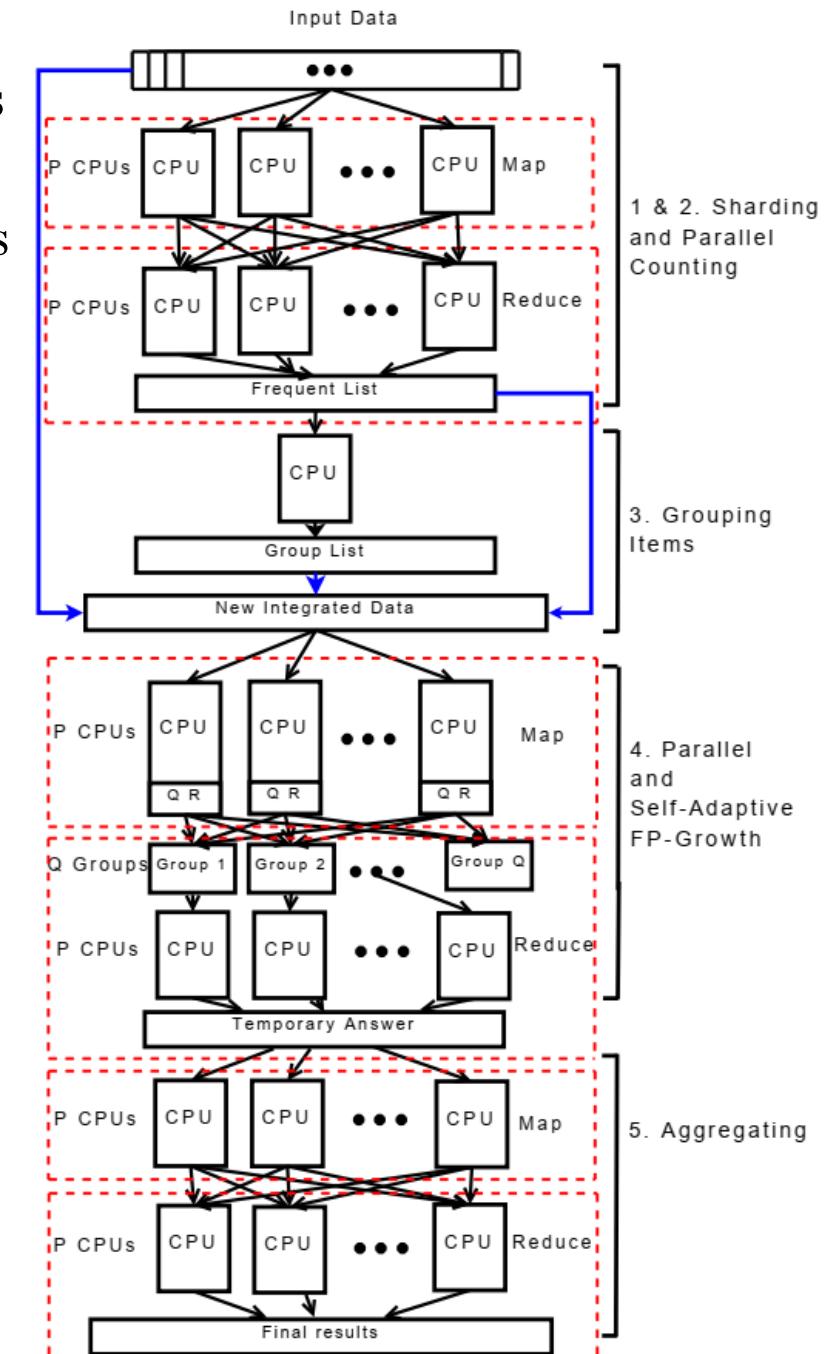
Li, Haoyuan, et al. "PFP: Parallel FP-Growth for query recommendation." *Proceedings of the 2008 ACM Conference on Recommender systems*. 2008.

PFP: Parallel FP-Growth

Example of MapReduce FP-Growth: Five transactions composed of lower-case alphabets representing items

Map inputs (transactions) key="" : value	Sorted transactions (with infrequent items eliminated)	Map outputs (conditional transactions) key: value	Reduce inputs (conditional databases) key: value	Conditional FP-trees
f a c d g i m p	f c a m p	p: f c a m m: f c a a: f c c: f	p: { f c a m / f c a m / c b }	{(c:3)} p
a b c f l m o	f c a b m	m: f c a b b: f c a a: f c c: f	m: { f c a / f c a / f c a b }	{ (f:3, c:3, a:3) } m
b f h j o	f b	b: f	b: { f c a / f / c }	{ } b
b c k s p	c b p	p: c b b: c	a: { f c / f c / f c }	{ (f:3, c:3) } a
a f c e l p m n	f c a m p	p: f c a m m: f c a a: f c c: f	c: { f / f / f }	{ (f:3) } c

- **Sharding:** Divide DB into successive parts and storing the parts (as a Shard) on P different computers.
- **Parallel Counting:** MapReduce counts the support of all items that appear in DB. Each mapper inputs one shard of DB. The result is stored in F-list.
- **Grouping Items:** Dividing all the items on F-List into Q groups of a list (G-list).
- **Parallel FP-Growth:**
 - **Mapper:** Each mapper uses a Shard. It reads a transaction in the G-list and outputs one or more key-value pairs, where each key is a *group-id* and value is a **group-dependent transaction**.
 - For each *group-id*, the MapReduce groups all group-dependent transactions into a shard.
 - **Reducer:** Each reducer processes one or more group-dependent Shard. For each shard, a reducer builds a local FP-Tree and discover patterns.
- **Aggregating:** Aggregate the results generated as final result.



PFP: Parallel FP-Growth

- FP-Growth implementation takes the following (hyper-)parameters
 - minSupport: the minimum support for an itemset to be identified as frequent e.g., if an item appears 3 out of 5 transactions, it has a support of $3/5=0.6$.
 - minConfidence: minimum confidence for generating Association Rule e.g., if in the transactions itemset X appears 4 times, X and Y co-occur only 2 times, the confidence for the rule $X \Rightarrow Y$ is then $2/4 = 0.5$.
 - numPartitions: the number of partitions used to distribute the work.
- FP-Growth model provides:
 - freqItemsets: frequent itemsets in the format of DataFrame(“items”[Array], “freq”[Long])
 - associationRules: association rules generated with confidence above minConfidence, in the format of DataFrame(“antecedent”[Array], “consequent”[Array], “confidence”[Double]).

```
import java.util.Arrays;
import java.util.List;

import org.apache.spark.ml.fpm.FPGrowth;
import org.apache.spark.ml.fpm.FPGrowthModel;
import org.apache.spark.sql.Dataset;
import org.apache.spark.sql.Row;
import org.apache.spark.sql.RowFactory;
import org.apache.spark.sql.SparkSession;
import org.apache.spark.sql.types.*;

List<Row> data = Arrays.asList(
    RowFactory.create(Arrays.asList("1 2 5".split(" "))),
    RowFactory.create(Arrays.asList("1 2 3 5".split(" "))),
    RowFactory.create(Arrays.asList("1 2".split(" ")))
);
StructType schema = new StructType(new StructField[]{ new StructField(
    "items", new ArrayType(DataTypes.StringType, true), false, Metadata.empty())
});
Dataset<Row> itemsDF = spark.createDataFrame(data, schema);

FPGrowthModel model = new FPGrowth()
    .setItemsCol("items")
    .setMinSupport(0.5)
    .setMinConfidence(0.6)
    .fit(itemsDF);

// Display frequent itemsets.
model.freqItemsets().show();

// Display generated association rules.
model.associationRules().show();

// transform examines the input items against all the association rules and summarize the
// consequents as prediction
model.transform(itemsDF).show();
```

PFP: Parallel FP-Growth

Ubiquitous Computing

- ❑ Big Data Analytics (Apache Spark (SQL, Mllib, GraphX))
- ❑ **Ubiquitous Computing**
 1. Edge Computing
 2. Cloudlet
 3. Fog computing
 4. Internet of Things (IoT)
 5. Virtualization
 6. Virtual Conferencing
 7. Virtual Events (2D, 3D, and Hybrid)

Ubiquitous computing

- Mark Weiser: Three basic ubiquitous computing devices:
 - Tabs: a wearable device that is approx in centimeters
 - Pads: a hand-held device that is approximately a decimeter in size
 - Boards: an interactive larger display device that is approximately a meter in size
- computing is made to appear anytime and everywhere
- any device, in any location, and in any format

Weiser, Mark. "The computer for the 21st century." *ACM SIGMOBILE mobile computing and communications review* 3.3 (1999): 3-11.

https://en.wikipedia.org/wiki/Ubiquitous_computing

Edge computing

- Distributed computing paradigm
- Computation and data storage closer to the user location
- Improve response times and save bandwidth
- Cloud computing operates on big data, whereas Edge computing operates on “instant data”
- Content Delivery Network or Content Distribution Network (CDN) (Refer to Unit 4)
- Akamai CDN (Refer to Unit 4)
- Akamai-Facebook’s Photo-Serving Stack (Refer to Unit 4)

Cloudlet

- First coined by Mahadev Satyanarayanan (Satya), Victor Bahl, Ramón Cáceres, and Nigel Davie
- It is a mobility-enhanced small-scale cloud datacenter that is located at the edge of the Internet.
- It work as a *data center in a box* which *brings the cloud closer*.
- Support resource-intensive and interactive mobile applications by providing powerful computing resources to mobile devices with lower latency.

Fog computing

- Architecture that distributes computing, storage, control and networking functions closer to the users along a cloud-to-thing.
- Fog computing is often erroneously called edge computing, but there are key differences.
- Fog works with the cloud, whereas edge is defined by the exclusion of cloud.
- Fog is hierarchical where edge tends to be limited to a small number of layers.
- Cloud computing deal with Big Data, whereas Fog computing deals with real-time data generated by sensors or users.

¹ IEEE Standard Association. "IEEE 1934-2018-IEEE Standard for adoption of OpenFog reference architecture for fog computing." (2018).

https://en.wikipedia.org/wiki/Fog_computing

Internet of Things (IoT)

- The network of physical objects —“things”— embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the Internet.
- Example:
 - “Smart Home” devices and appliances,
 - “Smart city” equipment and facilities,
- Real-Time Data Analytics
- *Information explosion or Data Deluge*
 - due to *data flood* or *information flood*
 - ever-increasing amount of electronic data exchanged per time unit
 - unmanageable amounts of data growth V/S power of data processing

Virtualization

- Virtual computer hardware platforms, storage devices, and computer network resources.
- *Hardware virtualization* or *platform virtualization* refers to the creation of a Virtual Machine (VM).
 - Full virtualization – complete simulation of the actual hardware to allow software environments, guest operating system and its apps.
 - Paravirtualization – the guest apps are executed in their own isolated domains.
- Application virtualization and Workspace virtualization: isolating individual apps from the underlying OS and other apps
- Service virtualization: emulating the behavior of API, Cloud and SOA

Virtualization

- Memory virtualization: aggregating RAM resources from networked systems into a single memory pool
- Virtual memory: giving an app the impression that it has contiguous working memory, isolating the underlying physical memory
- Storage virtualization: the process of completely abstracting logical storage from physical storage
- Distributed file system: any file system that allows access to files from multiple hosts sharing via a computer network
- Virtual file system: an abstraction layer on top of a more concrete file system
- Storage hypervisor: combines physical storage resources into one or more flexible pools of logical storage

Virtualization

- Virtual disk: emulates a disk drive such as a hard disk drive or optical disk drive
- Data virtualization: the presentation of data as an abstract layer, independent of underlying database systems, structures and storage
- Database virtualization: the decoupling of the database layer, which lies between the storage and application layers
- Network virtualization: creation of a virtualized network addressing space within or across network subnets
- Virtual private network (VPN): replaces the actual wire or other physical media in a network with an abstract layer

Virtual Conferencing

- Teleconference: Phone lines, Landlines or Cellular devices
- Video conference:
 - Webcam, Microphone, Speaker, Internet
 - hardware, software, devices is dedicated for this
- Web Conference: Internet and Cloud supported
 - Web 2.0
 - Well-Known: Google Meet, Skype, and Microsoft Team
 - Multi-Communications from Many sender to Many receivers
 - Webinars ("web seminars"), Webcasts (live media presentation), Podcast (audio presentation), and web meetings
 - **Virtual Events**

Virtual Events

- An online event involves people interacting in a virtual environment on the web, instead of physical meeting.
- Multi-session online events often feature webinars and webcasts.
- Aim to create similar experience as physical meeting.
- Live-streaming the event online or on-demand video.
- Issues
 - Echo of voice
 - Audio and Videography logistics
 - Network Bandwidth of conferencing server and users

2D Virtual Events: Live Streaming

← Leave

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Animesh Chaturvedi

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Exhibition | Remember M...

Detail

Stage

Dialogue: Hoare/Lamport

09/21/2020 | 6:30 PM - 7:20 PM

This session begins in your time zone on 09/21/2020 at 10:00 PM.

Speakers (2)

Tony Hoare

Leslie Lamport

as my career goal.

VIRT HEIDELBERG LAUREATE FORUM

Scientific Dialogue
Sir C. Antony R. Hoare
Leslie Lamport

Comment... Send

1000 characters left

2 Comments chronologically ↗

Roy Levin 3 minutes ago

ACM recently published a substantial retrospective on Leslie Lamport's career and technical work as "Concurrent: The Works"

3D Virtual Event: Live Video



3D Virtual Event:



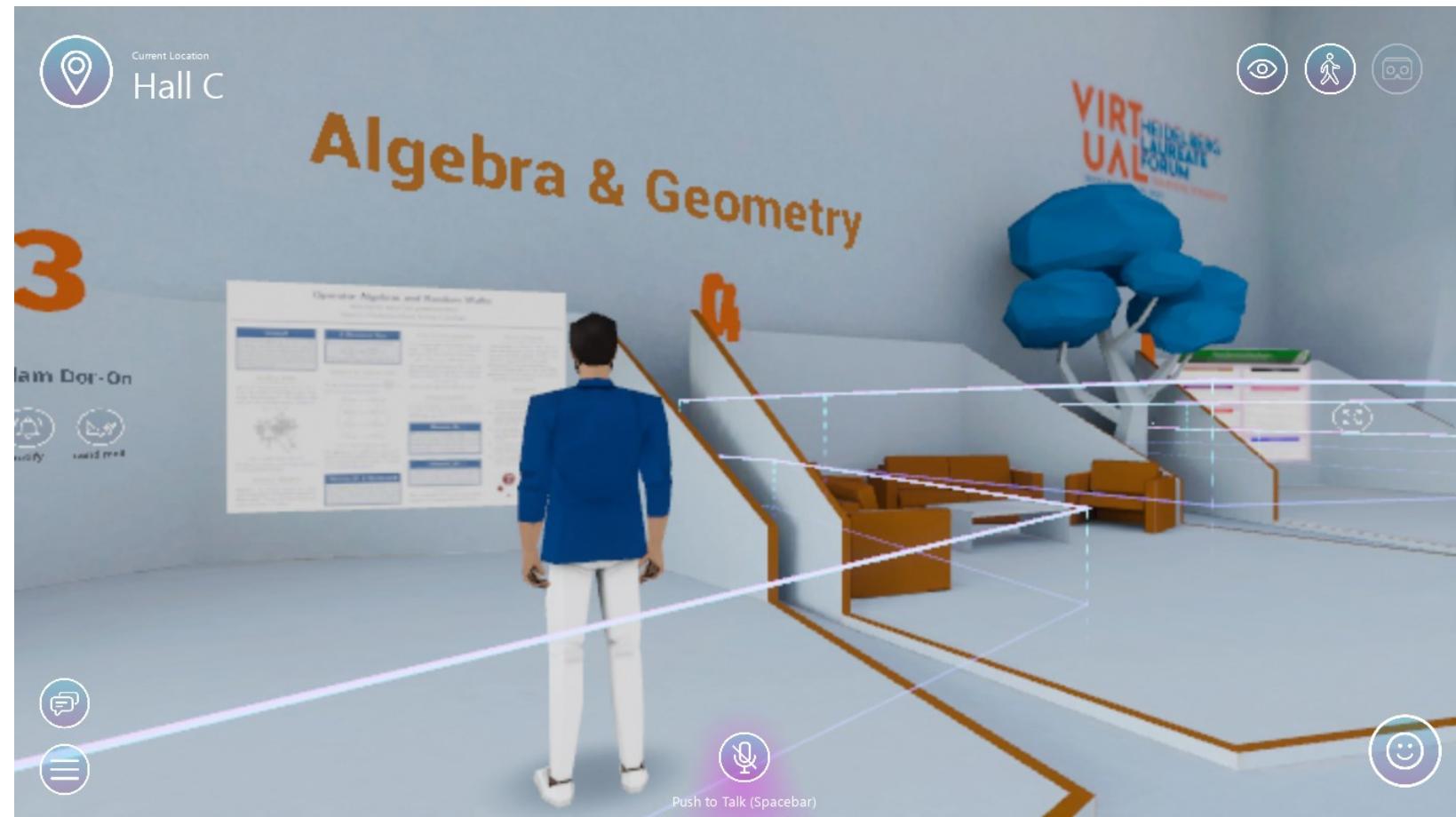
3D Virtual Event: Poster Sessions



3D Virtual Event: Poster Sessions



3D Virtual Event: Poster Sessions



3D Virtual Event: Poster Sessions



3D Virtual Event: Virtual Gathering



3D Virtual Event: Recreations



3D Virtual Event: Virtual Dancing



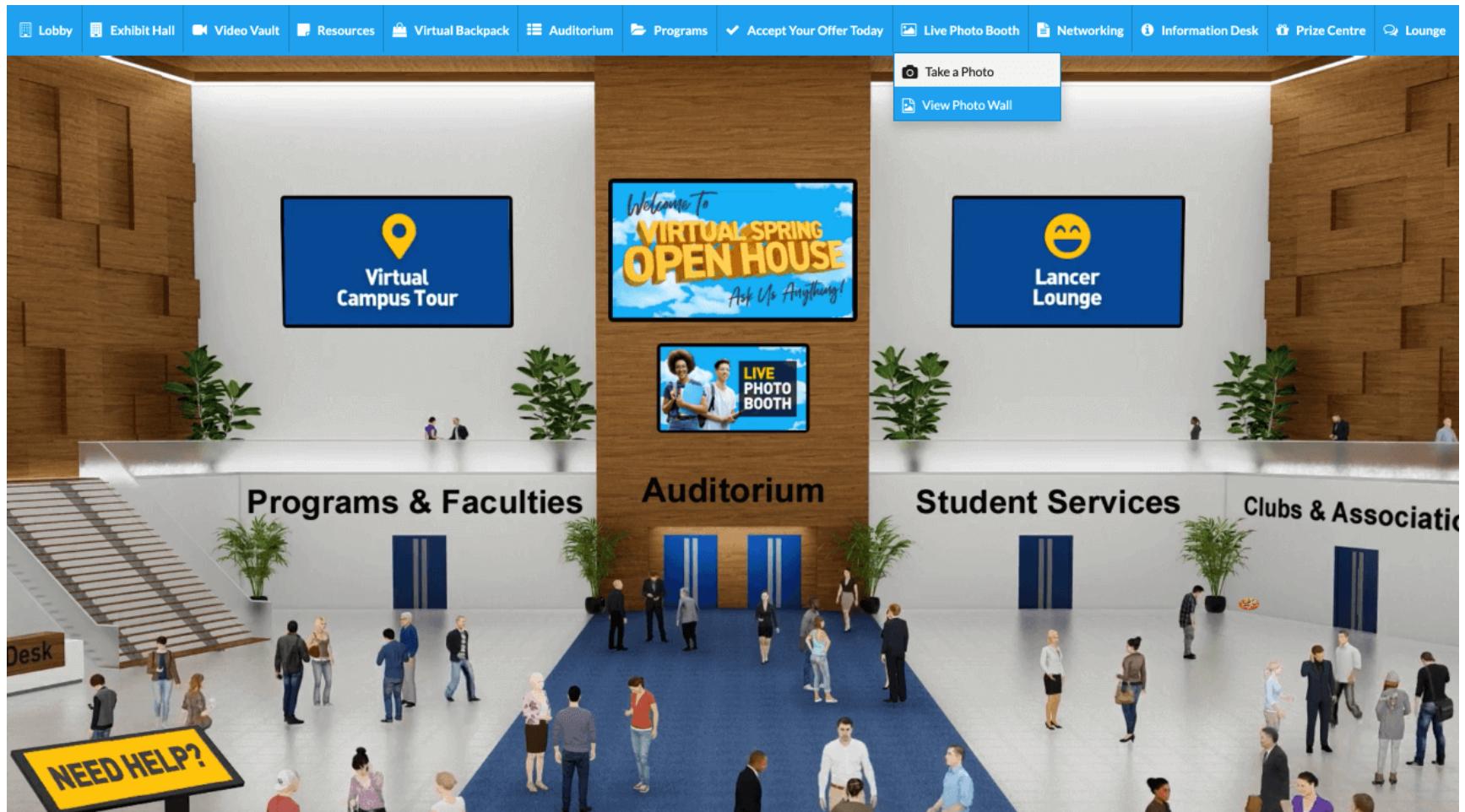
Hybrid Event

- Combines a "physical" in-person event with a "virtual" online component
- Tradeshow, Conference, Seminar, Workshop, Convocation

Hybrid Event: Landing Page



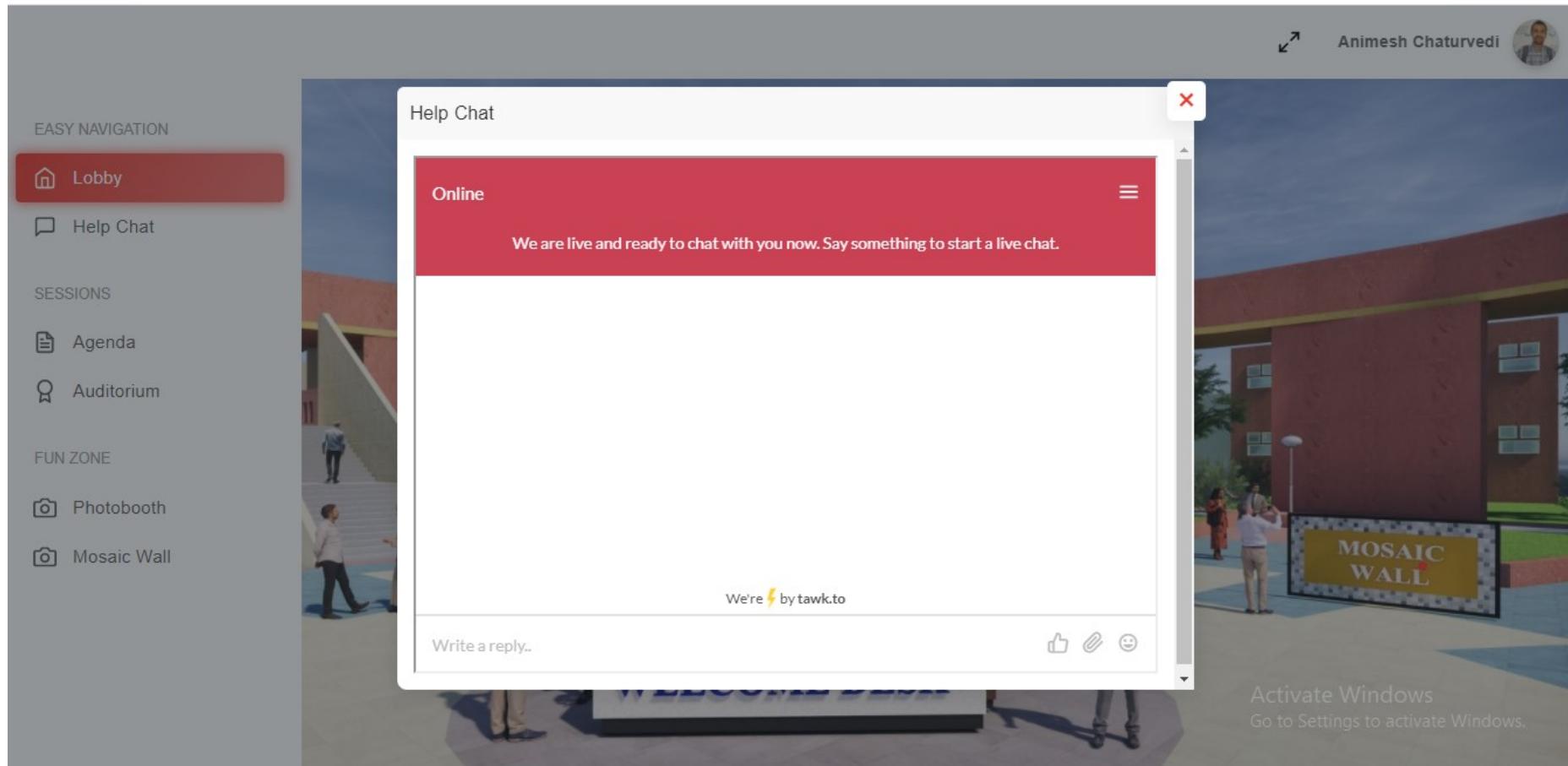
Hybrid Event: Landing Page



Hybrid Event: PhotoBooth

The image displays a collection of 18 user-generated photographs from a virtual photo booth. Each photo is framed by a white border and a blue diagonal banner in the bottom right corner that reads "FUTURE LANCER". The photos are organized into three horizontal rows. The top row contains five photos of individuals and one button: "Take a Photo" (with a camera icon) and "View Photo Wall" (with a photo album icon). The middle row contains six photos, including one of two people together. The bottom row contains five photos, including one of a person wearing headphones and one of a person standing next to a sign that says "Essex Hall". The background of each photo varies, showing different indoor and outdoor settings.

Hybrid Event: Help Chat FrontEnd



Hybrid Event: Help Chat BackEnd

The screenshot shows a hybrid event help chat interface. On the left, there's a sidebar with icons for Home, Groups (1), Direct Messages (1), and other communication channels. The main area displays an active chat window titled "Active Chats". The chat log shows a visitor message "hi" at 16:25, followed by a response "hello". The visitor then says "hi" again at 16:25. A message from "V1605950166179364" follows: "Amazing work" and "Bye!". Below this, a note states "Visitor closed the popout window". The visitor replies "thanks 😍" at 16:25. The visitor then leaves at 16:27. The right side of the interface shows a summary of the chat session: "Visitor Email" (redacted), "Balotra, India", timestamp "4:27 PM", duration "00:02:24", duration "57m", and "1 chats". A log of events is also present: "Chat ended" at 16:27, "Visitor closed the popout window" at 16:25, and "Chat started" at 16:25.

Active Chats

V1605950166179364

hi

hello

hi

V1605950166179364

Amazing work

Bye!

Visitor closed the popout window

thanks 😍

Visitor left

Message Whisper

V1605950166179364

Visitor Email

Balotra, India

4:27 PM

00:02:24 57m 1 chats

16:27 Chat ended

16:25 Visitor closed the popout window

16:25 Chat started

Hybrid Event: Virtual and Physical Degree

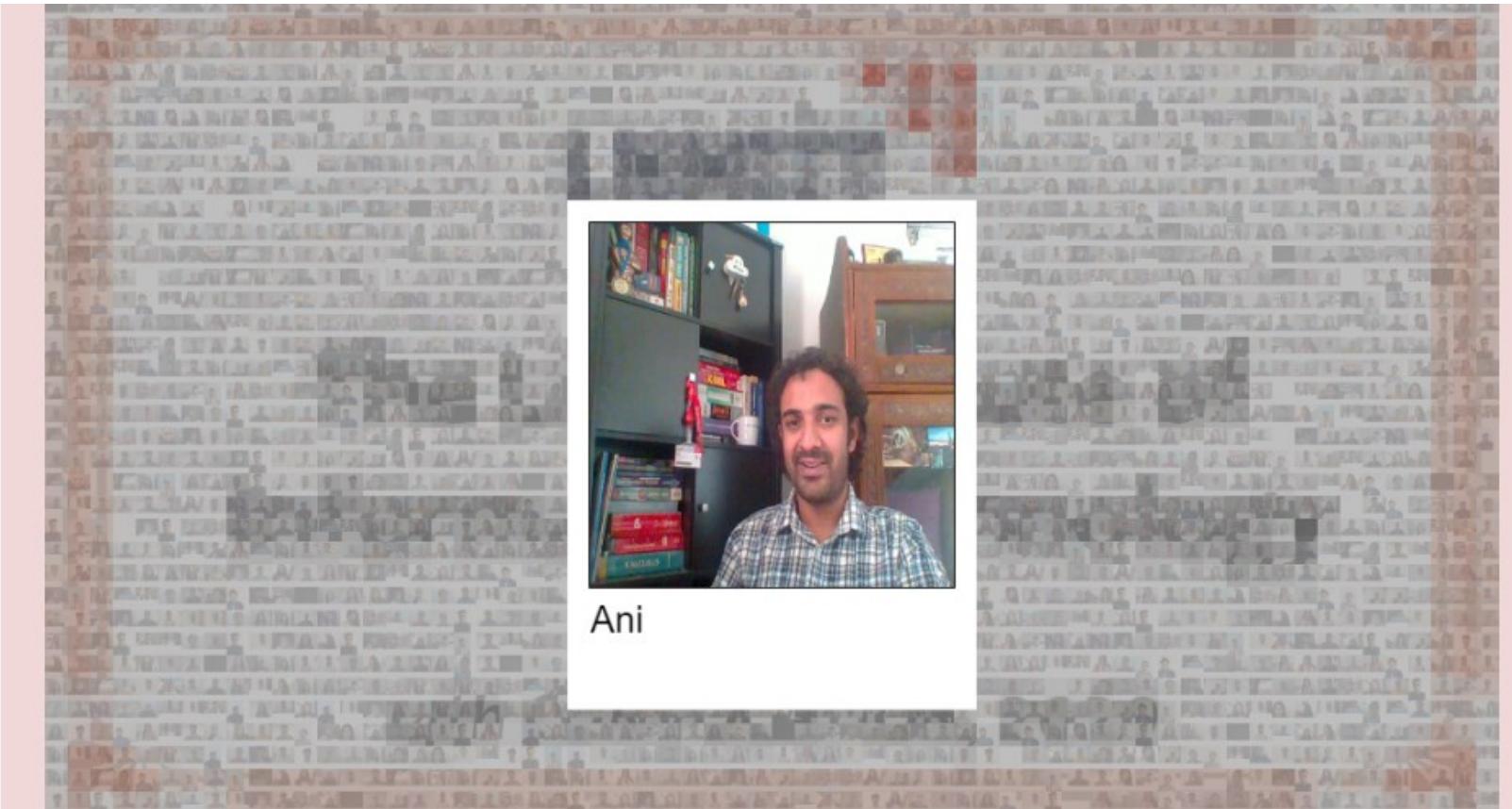
LNMIITTM



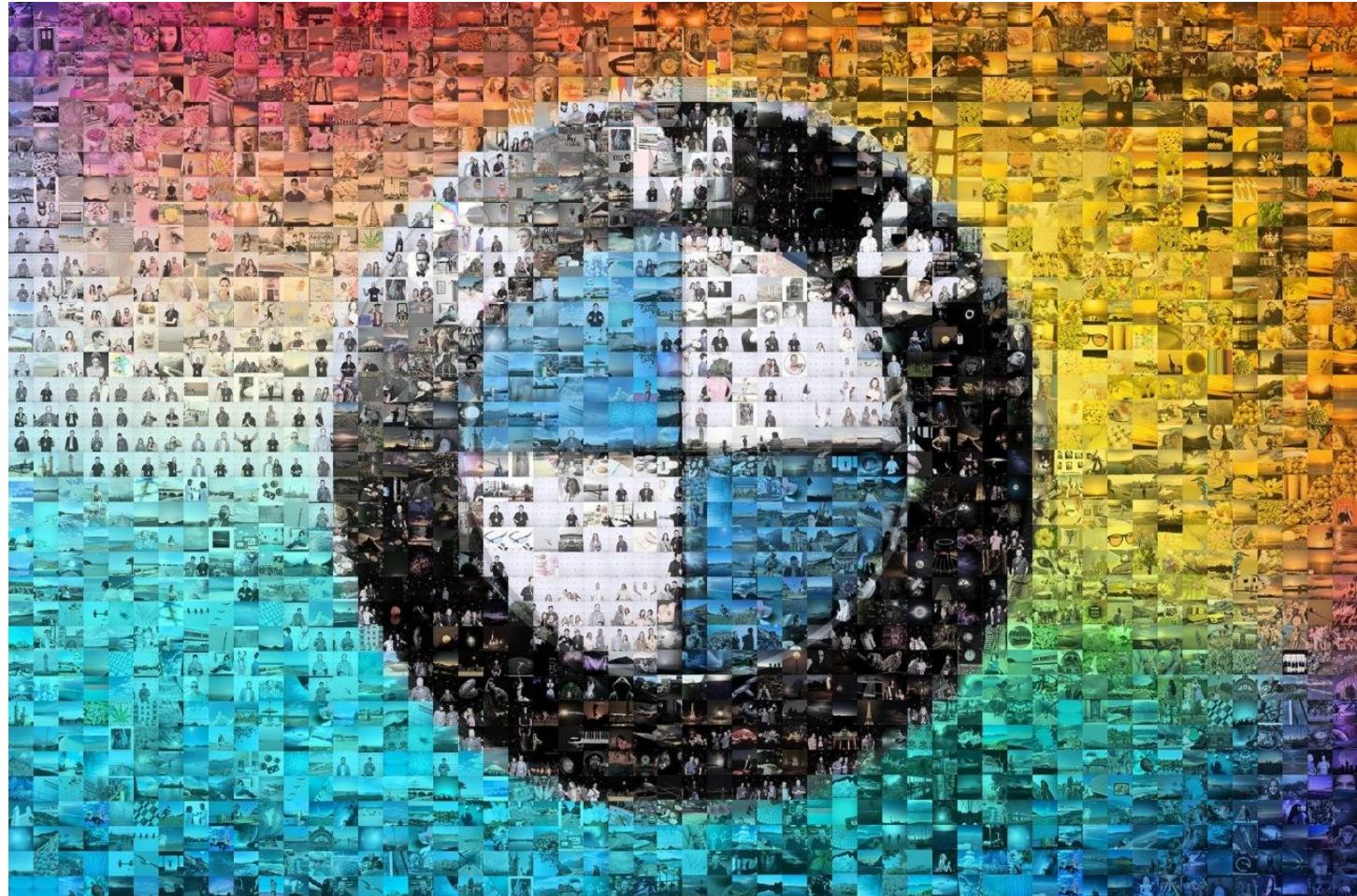
→ Animesh Chaturvedi



Hybrid Event: Mosaic Wall



Hybrid Event: Mosaic Wall

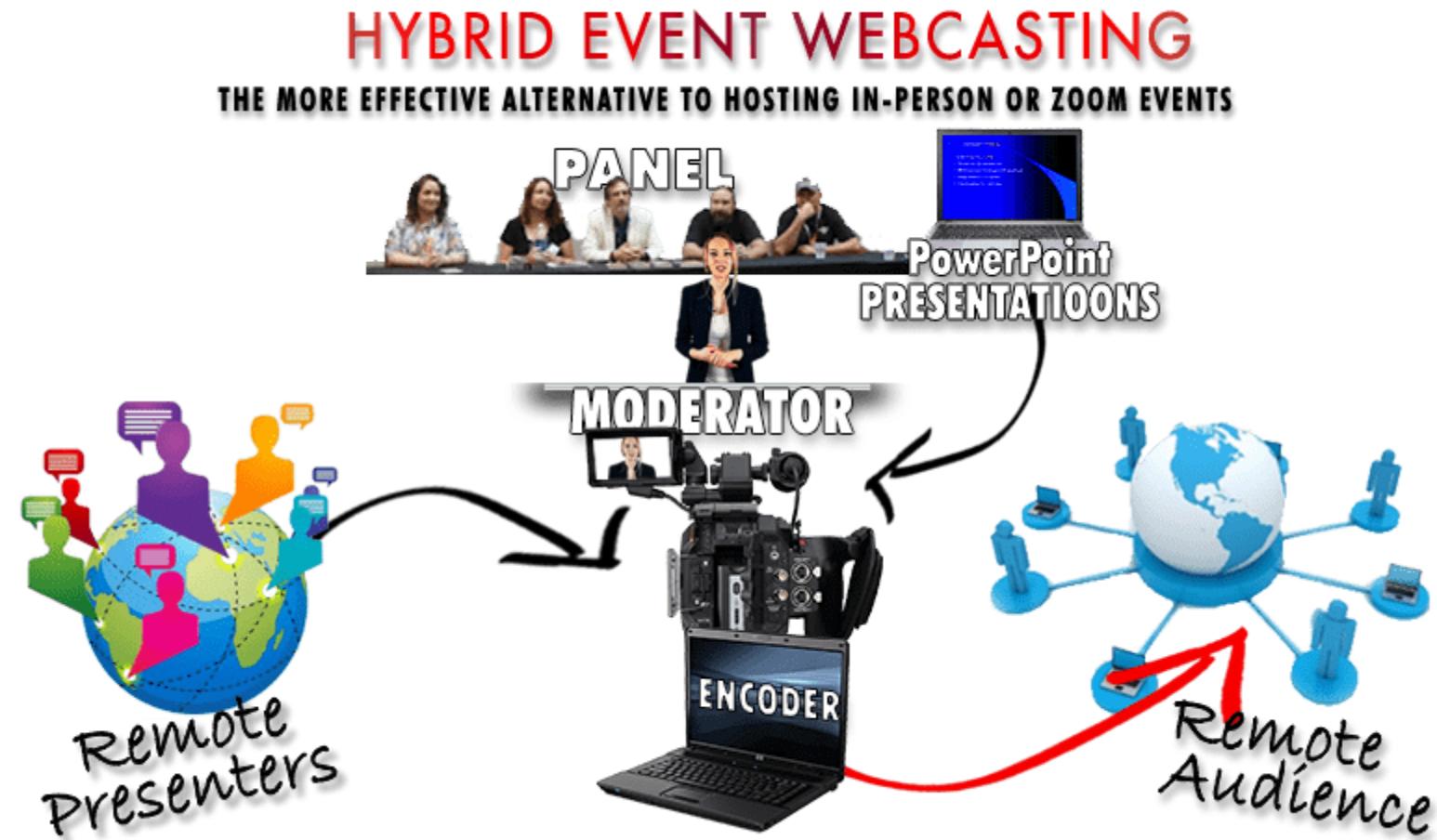


<https://www.youtube.com/watch?v=BSwJCRKvmPc>

Hybrid Event: Blowing Flower Effect



Hybrid Event: Welcome WebCast



Hybrid Event: Virtual Address



2D Virtual Event: Live Streaming

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VIRTHEIDELBERG LAUREATE FORUM

SEPTEMBER 21-25 2020

Animesh Chaturvedi

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Stage

Dialogue: Hoare/Lamport

09/21/2020 | 6:30 PM - 7:20 PM

This session begins in your time zone on 09/21/2020 at 10:00 PM.

Speakers (2)

Tony Hoare

Leslie Lamport

as my career goal.

VIRT HEIDELBERG LAUREATE FORUM

Scientific Dialogue
Sir C. Antony R. Hoare
Leslie Lamport

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1000 characters left

2 Comments chronologically ↗

Roy Levin 3 minutes ago

ACM recently published a substantial retrospective on Leslie Lamport's career and technical work as "Concurrent: The Works"

3D Virtual Event: Live Video



3D Virtual Event:



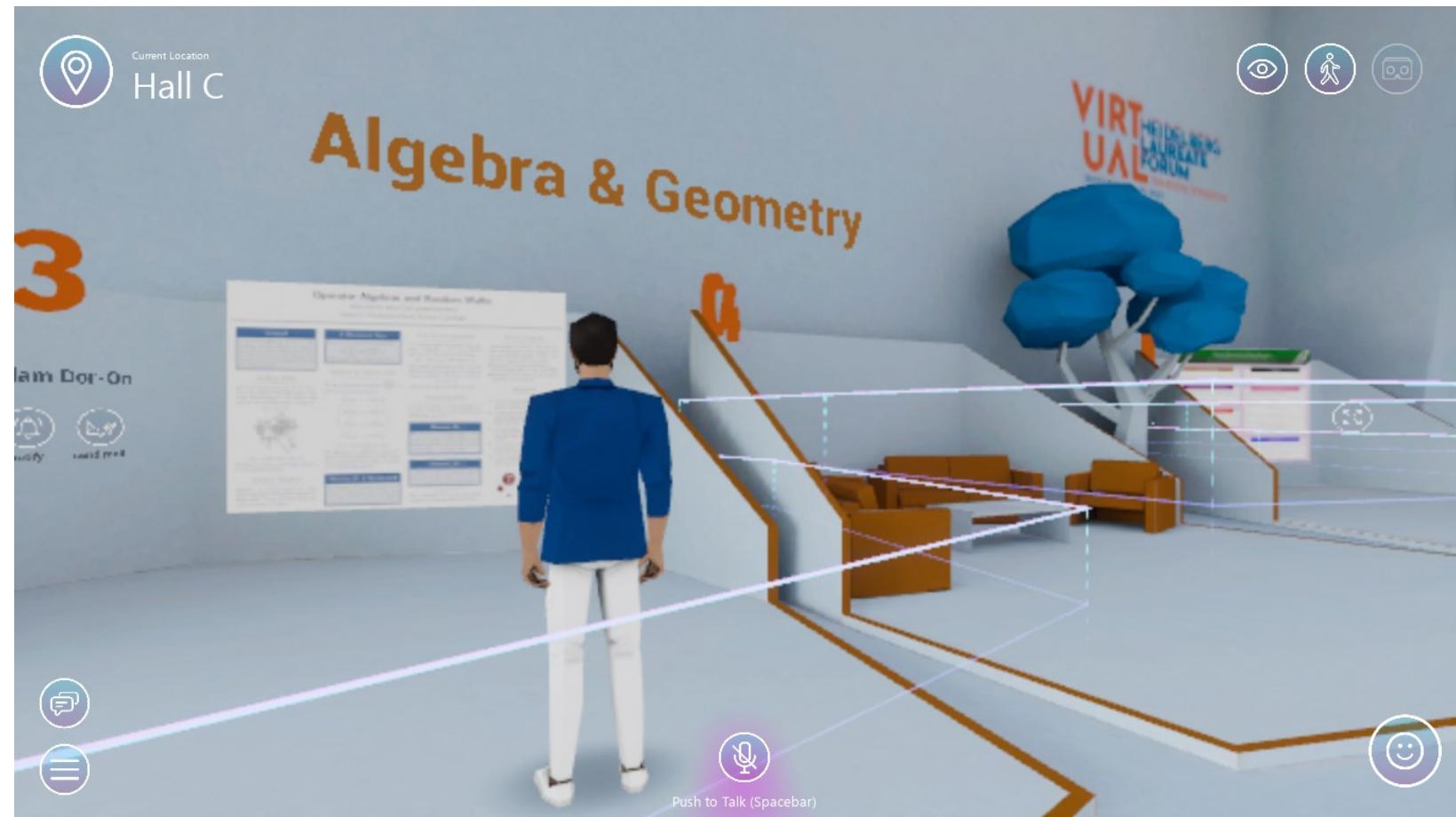
3D Virtual Event: Poster Sessions



3D Virtual Event: Poster Sessions



3D Virtual Event: Poster Sessions



3D Virtual Event: Poster Sessions



3D Virtual Event: Virtual Gathering



3D Virtual Event: Recreations

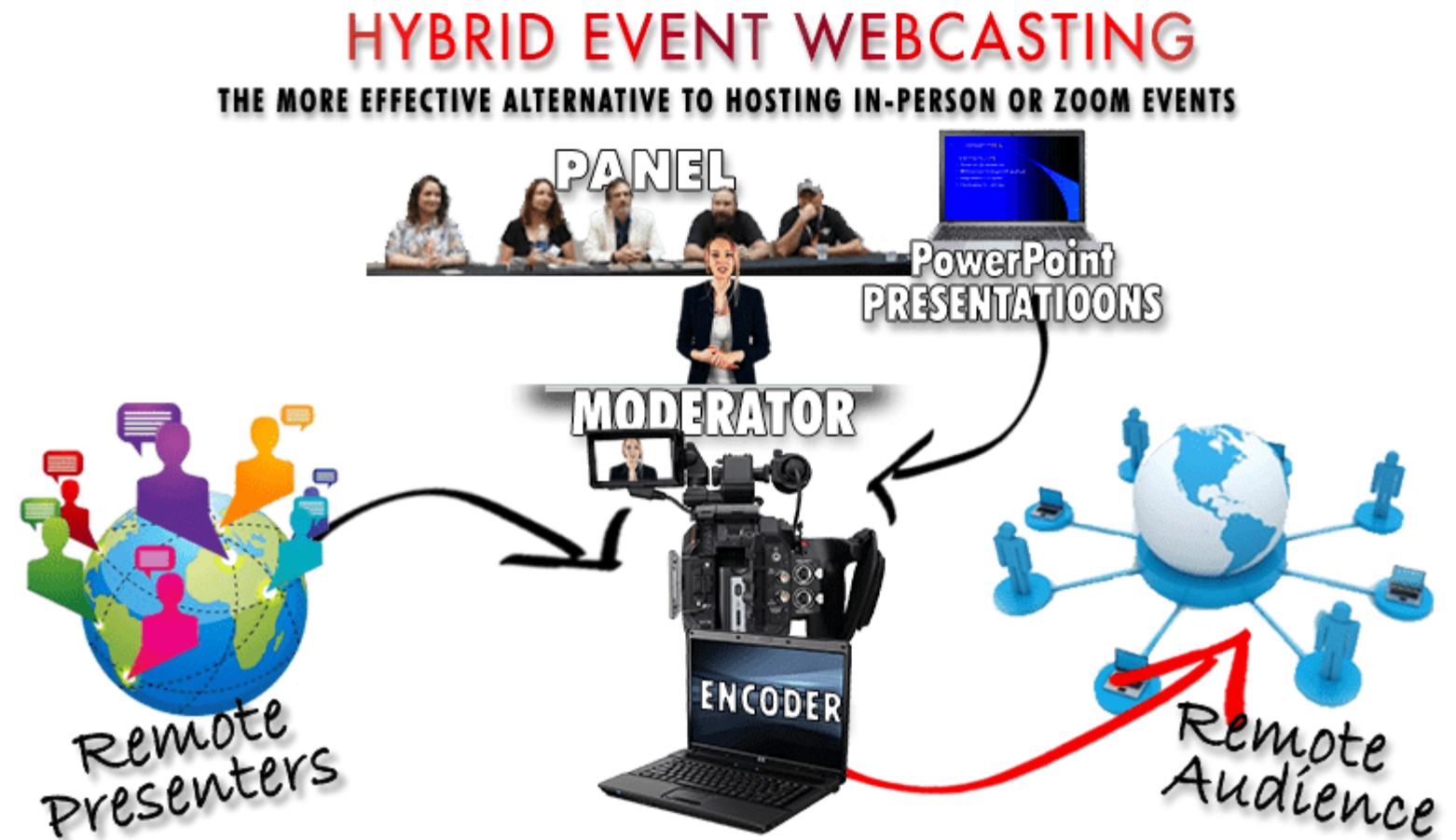


3D Virtual Event: Virtual Dancing



Hybrid Event

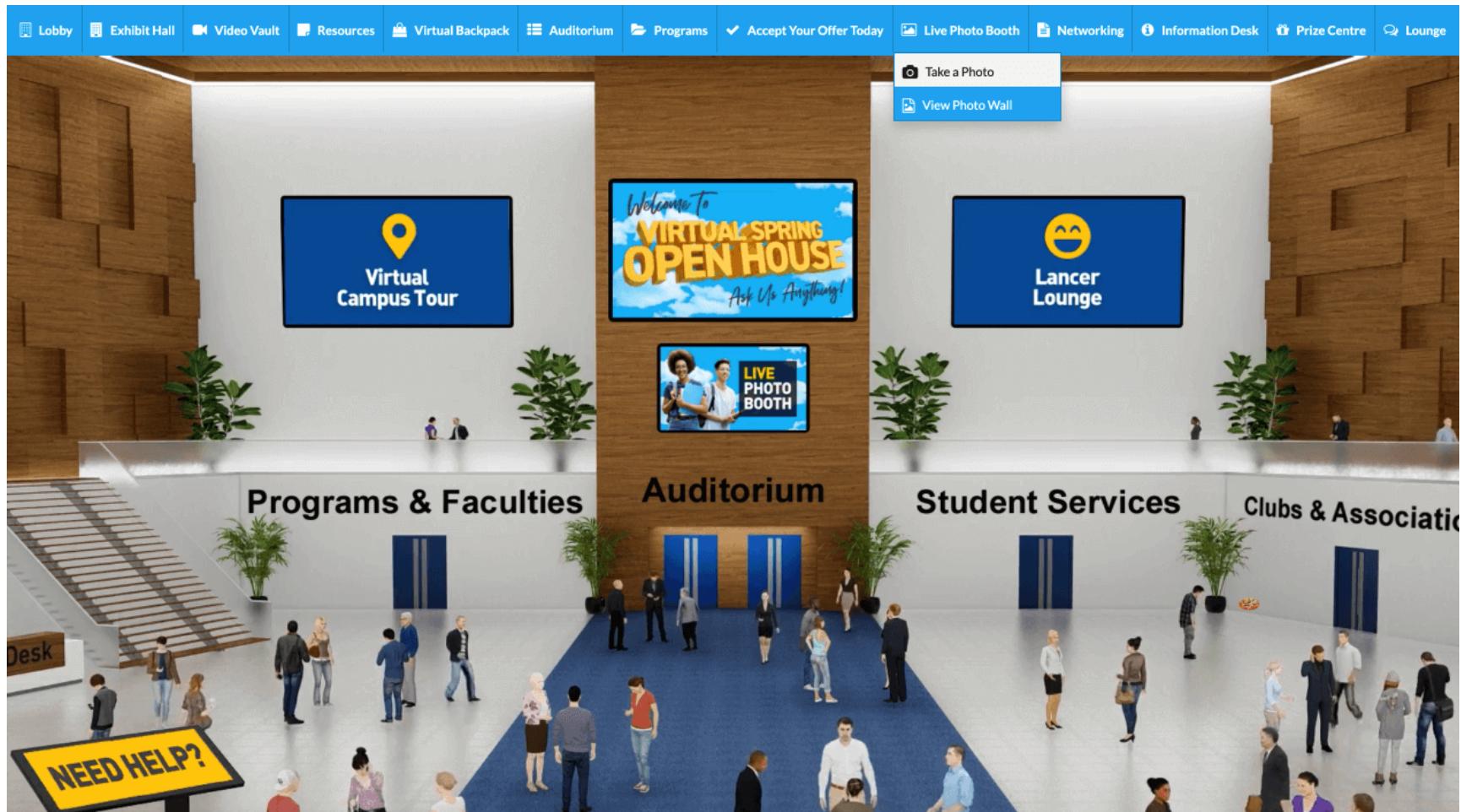
- Combines a "physical" in-person event with a "virtual" online component
- Tradeshow, Conference, Seminar, Workshop, Convocation



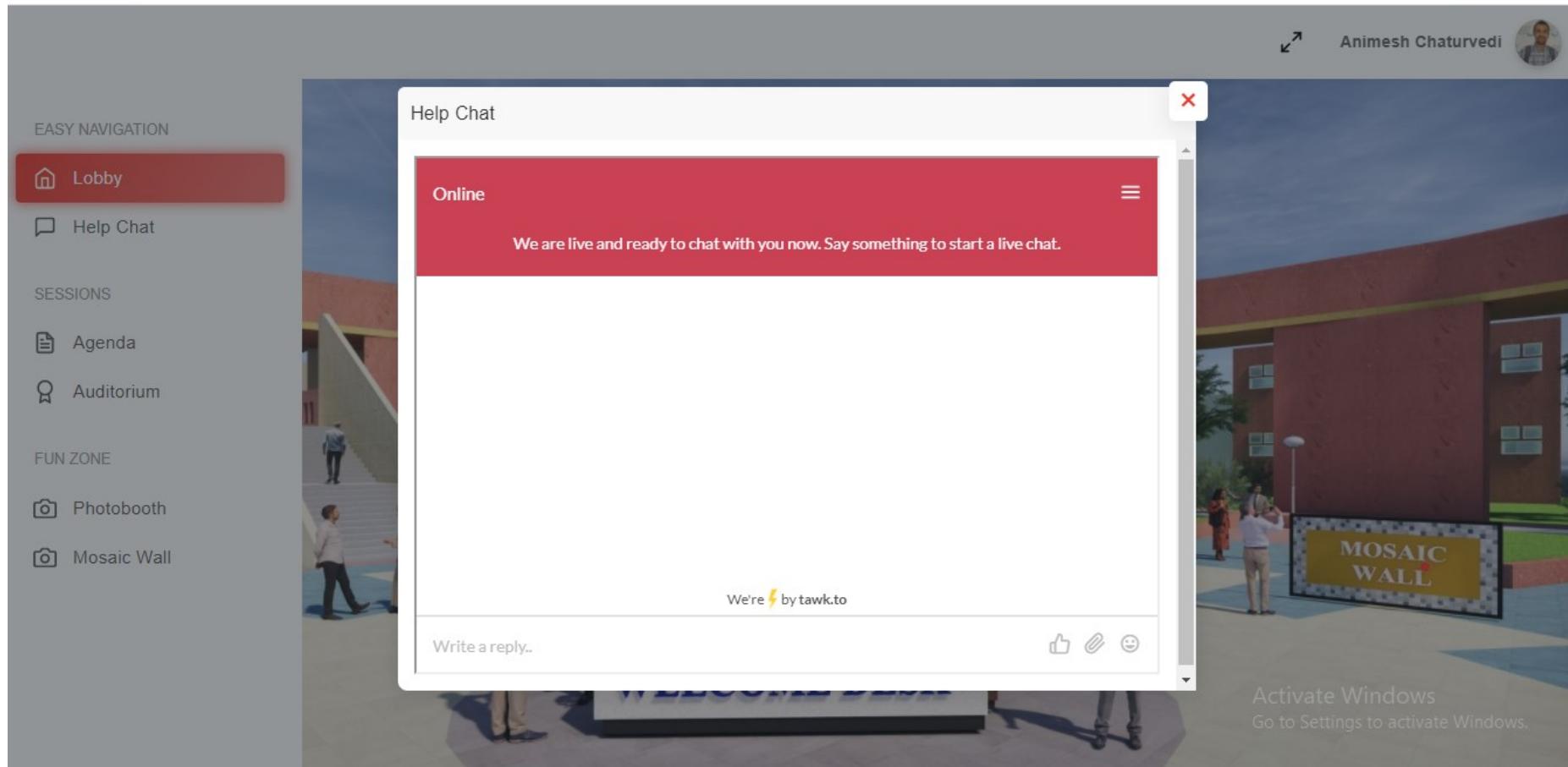
Hybrid Event: Landing Page



Hybrid Event: Landing Page



Hybrid Event: Help Chat FrontEnd



Hybrid Event: Help Chat BackEnd

The screenshot shows a hybrid event help chat interface. On the left, there's a sidebar with icons for Home, Groups (1), Direct Messages (1), and other communication channels. The main area displays an active chat window with a visitor from 'Balotra, India' (Visitor Email). The conversation log includes messages like 'hi', 'hello', 'Amazing work', 'Bye!', 'Visitor closed the popout window', 'thanks 😍', and 'Visitor left'. A summary on the right indicates a total duration of 00:02:24 over 57 minutes across 1 chat. The interface also shows a 'Visitor closed the popout window' event at 16:25 and a 'Chat ended' event at 16:27.

Active Chats

V1605950166179364

hi

hello

hi

V1605950166179364

Amazing work

Bye!

Visitor closed the popout window

thanks 😍

Visitor left

Message Whisper

16:25 16:25 16:25 16:25 16:27

Visitor Email

Balotra, India 4:27 PM

00:02:24 57m 1 chats

16:27 Chat ended

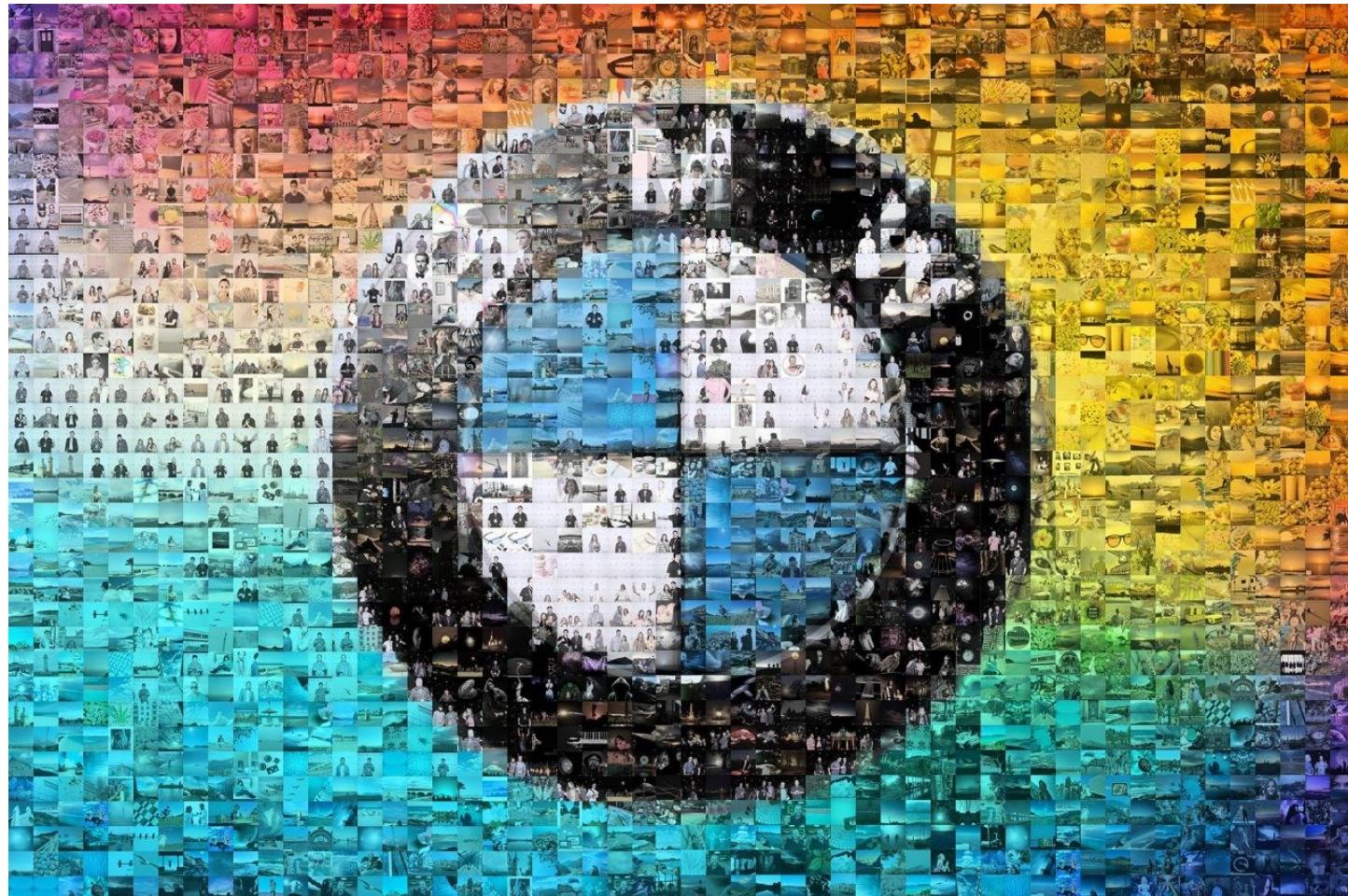
16:25 Visitor closed the popout window

16:25 Chat started

Hybrid Event: PhotoBooth

The image shows a digital photo booth interface for the University of Windsor. It features a grid of 24 individual photographs of diverse individuals, each with a blue diagonal overlay banner in the bottom right corner containing the white text "FUTURE LANCER". Above the grid, there is a horizontal navigation bar with various links: "Lobby", "Exhibit Hall", "Video Vault", "Resources", "Virtual Backpack", "Auditorium", "Programs", "Accept Your Offer Today", "Live Photo Booth", "Networking", "Information Desk", "Prize Centre", and "Lounge". In the center of the grid, there is a white rectangular overlay box with rounded corners. It contains two items: "Take a Photo" with a camera icon and "View Photo Wall" with a photo album icon.

Hybrid Event: Mosaic Wall



<https://www.youtube.com/watch?v=BSwJCRKvmPc>

Hybrid Event: Blowing Flower Effect



Hybrid Event: Virtual Address



Hybrid Event: Remote Connectivity



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ଧ୍ୟବାଦ:
Sanskrit

Ευχαριστώ
Greek

Спасибо
Russian

شکر

Arabic

多謝

Traditional
Chinese

多谢

Simplified
Chinese

Japanese

תודה רבה

Italian

Grazie

Hebrew

ಧನ್ಯವಾದಗಳು

Kannada

Thank You
English

Gracias
Spanish

Obrigado

Portuguese

Merci

French

ଧ୍ୟବାଦ

Hindi

Danke

German

நன்றி

Tamil

Tamil

ありがとうございました

감사합니다

Korean

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