

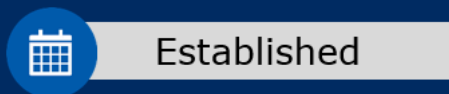
NEC Display Solutions

Le soluzioni di sicurezza tra innovazione ed efficienza

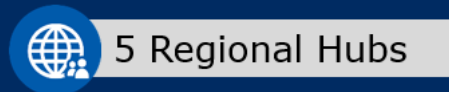
Convegno OSSIF, 14 Dicembre 2017

Massimiliano Carlesi





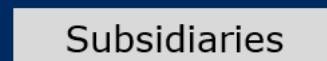
118 JULY
YEARS NOW 1899



~107,700
EMPLOYEES WORLDWIDE



22.3 351
BILLION EUR MILLION EUR



238



"NEC is committed to **empowering people** and society through continuous **innovation** in every area of our businesses, fuelled by our infinite **passion** for innovation and our **customer-focused** spirit of collaboration."

Vertical focus



Aviation & Transportation



Meeting room



Digital Signage



Corporate Solutions



Food & Beverages



Media



Energy & Utility



Retail



Finance & Insurance



Rental & Staging



Cinema



Healthcare



Entertainment & Leisure & Museums

NEC Display Value Proposition

- High quality products (e.g. metallic case, 12-bit LUT, colour calibration)
- Flexibility (e.g. OMi Open Modular intelligence)
- Scalability (horizontal and vertical)
- Integration (open API, AMX NetLinx support, Crestron RoomView support)
- Management and Control (NaViSet)
- Standard software platforms (Android, Linux, Windows)
- Wide range of HW solutions (LFD, Projectors, LED)
- Unique SW solutions (Neoface, Hiperwall)
- Service & Support

Physical Security

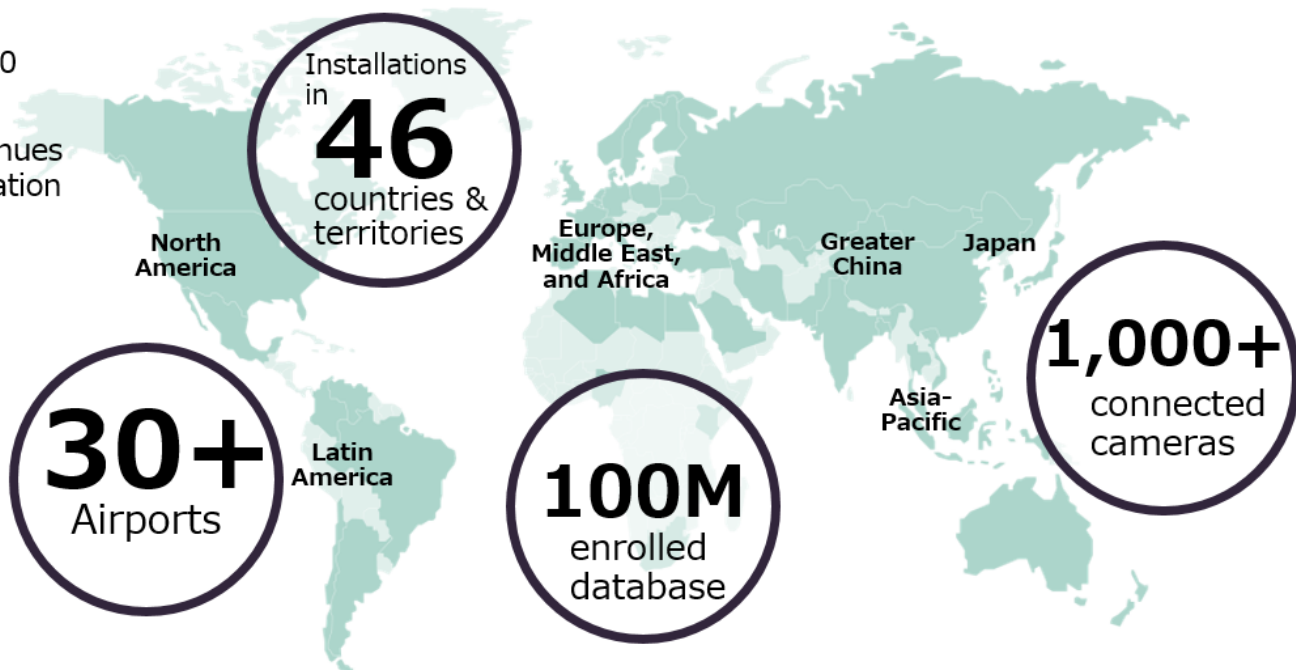
Neoface ®

NEC's Global Face Recognition Platform

- Network of 9 Labs focused on Global Research

- Employs over 1,000 R&D Professionals

- 5% of Global Revenues Allocated to Innovation



History of NEC's Face Recognition Technology

1963 Start character recognition technology R&D

1989 Start face recognition R&D

Application of pattern recognition technology established through character recognition R&D

2002 Commercialize face recognition SDK "NeoFace"

2009-2013 Rank No.1 in NIST*¹ Evaluation

3 consecutive wins in Still Image Matching

2009(MBGC*²), 2010(MBE*³), 2013(FRVT*⁴)

2017 Newly rank No.1 in Video Face Recognition Evaluation
NIST Face in Video Evaluation (FIVE*⁵)

Evaluation under various environmental conditions

**1963
Character
Recognition
R&D**

**1989
Face
Recognition
R&D**

**2009 2010 2013
NIST
Evaluation
3 Consecutive
Wins**



**Still Image
Matching**



**2017
NIST FIVE
No.1**



**Video
Face Recognition**

*1 US Institute of Standards and Technology
*2 MBGC (Multiple Biometric Grand Challenge)
*3 MBE (Multiple Biometrics Evaluation)
*4 FRVT (Face Recognition Vendor Test)
*5 FIVE (Face In Video Evaluation)

Face Recognition Technology Evaluation by NIST

Objective and fair evaluation of leading technology providers

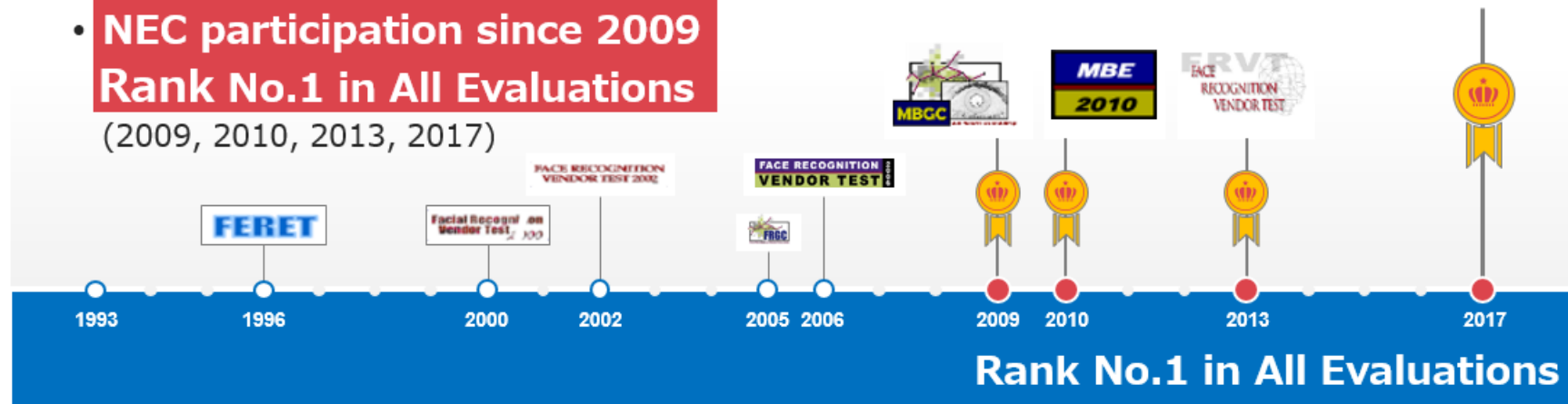
- Conducted benchmark evaluation for the past 20 years
- Participated by leading technology providers, academia and research institutes from around the world
- Evaluation is done through blind testing and is rigorous and fair
- Identification of various subjects (sex, age, race)



• **NEC participation since 2009**

Rank No.1 in All Evaluations

(2009, 2010, 2013, 2017)



Overview of Face In Video Evaluation (FIVE)

Benchmark evaluation of video face recognition Evaluation of recognition of non-cooperative subjects

- Start evaluation in **February 2015**. Final report issued in **March 2017**
- 16 leading technology provider took part. Sponsored by Department of Homeland Security (DHS)
- Application for **Access Control** and **Detection of suspicious individuals**
- Tested under various conditions (dataset, index, camera location, etc.)

Evaluation Ex1 : Passenger Gate

Entry-exit management at an airport passenger gate



*Images processed for privacy

Flusso incanalato e
con luce controllata

Evaluation Ex2 : Sports Arena

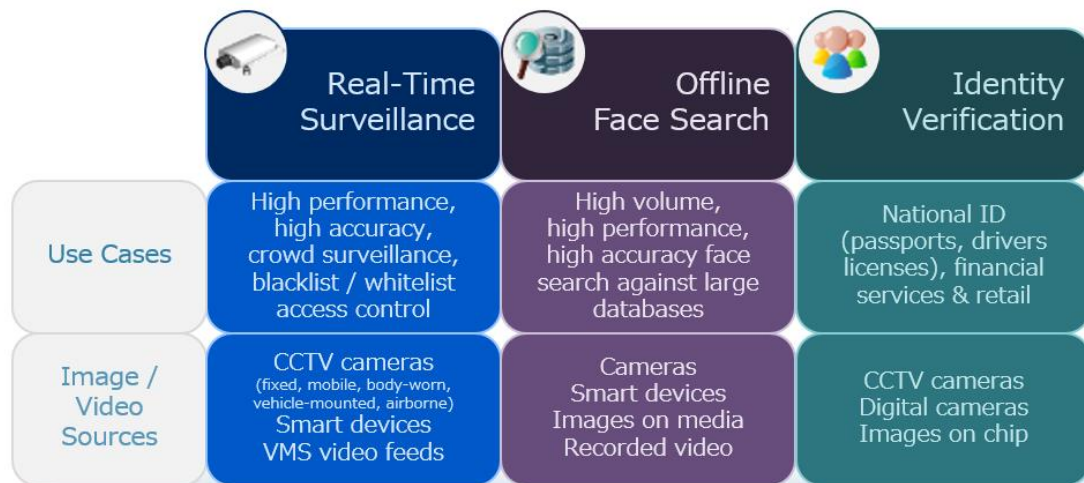
Detection of suspicious individuals at an indoor stadium



<https://www.nist.gov/programs-projects/face-video-evaluation-five>

Flusso non controllato
e con poca luce

Face Recognition Use Cases



Authentication, Investigation, Identification, & Monitoring

1:1 Authentication

Is this person who they claim to be?



- 1 face compared to 1 face
- Typically High Quality Images
- Controlled Environment, Simplest Use Case
- Accuracy is Critical, Speed is Secondary
- The System Design determines if a High Match Score or Low Match Score triggers a follow-on action, or if a human is needed to review the results.

1:n Investigation / Forensic Searches

Do we know this person?



- Accuracy is Critical
- Speed is Secondary
- Examiners create a case / structure a search
- Each search returns a **RANKED CANDIDATE LIST**
- **Humans consider the top Ranked Candidates and make a match decision.**
- It takes a few seconds to perform one search

n:n Identification / Real-Time Monitoring

Can we find these people?



- Face Detection, Accuracy and Speed are Critical
- Every search returns a **CANDIDATE LIST & MATCH SCORES**
- **Computer Systems consider the Match Scores and initiate an Automated Alert if the score is above a threshold.**
- Humans are not involved
- Hundreds of searches occur every second

**Static
Identification**

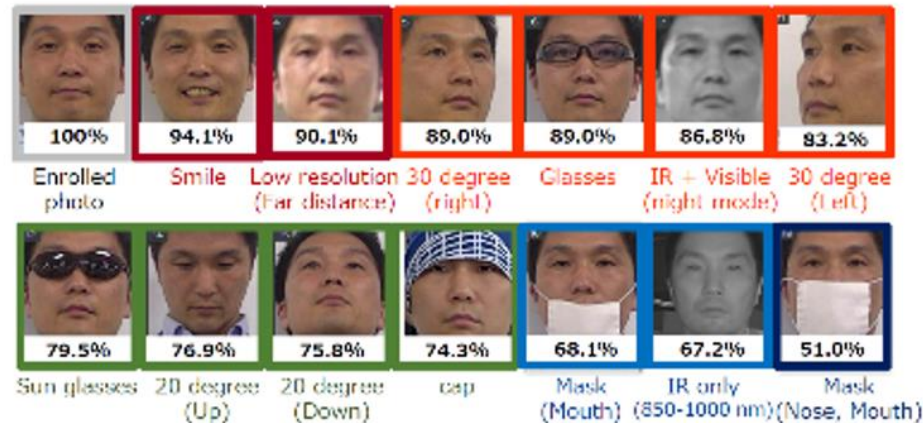
**Real-Time
Identification
in a Crowd**

**Most FR systems
cannot handle
real-time identification
properly!**

NeoFace M20 Algorithm | Overview

NeoFace was recently voted the top performing algorithm (lowest miss rate) in NIST FIVE...

- New algorithm allows angles of up 40° yaw, 30° roll and 30° pitch.
- Template size reduced to 2.6k.
- Support for NEC Accelerator technology.
- Rapid face detection algorithms provides predictive tracking of faces in frame.
- 4K resolution support.
- Improved algorithm support for various ethnic groups.
- Algorithm tuning for common head wear such as the Ghutra.



Improved resilience to real-world scenarios



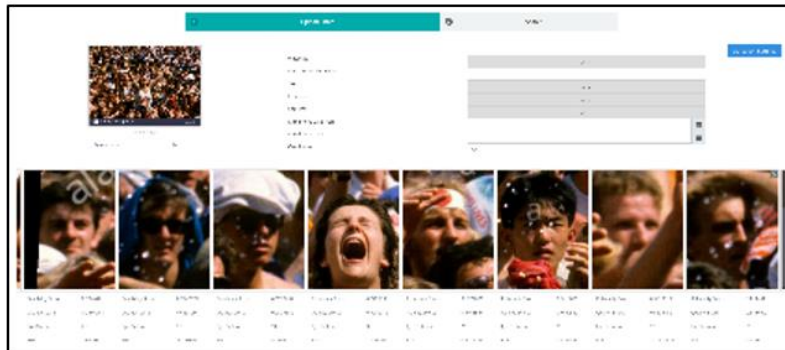
NeoFace M20 Algorithm | Improved Real-life Tolerance

NeoFace M20 has improved tolerance to real-world scenarios...

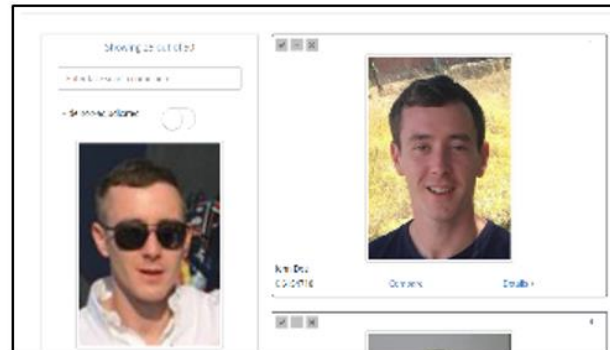
- Improved pose angle limits with up to 30 degrees pitch (from 15) and 40 degrees yaw (from 30).
- Improved face extraction of poor quality and low resolution images.
- More resilient to obscured faces (hats, glasses etc.).

Pose	NFW 3	NFW 4 (M20)
Yaw (L-R)	30°	40°
Pitch (U-D)	15°	30°
Roll	30°	30°

Improved pose angle tolerance

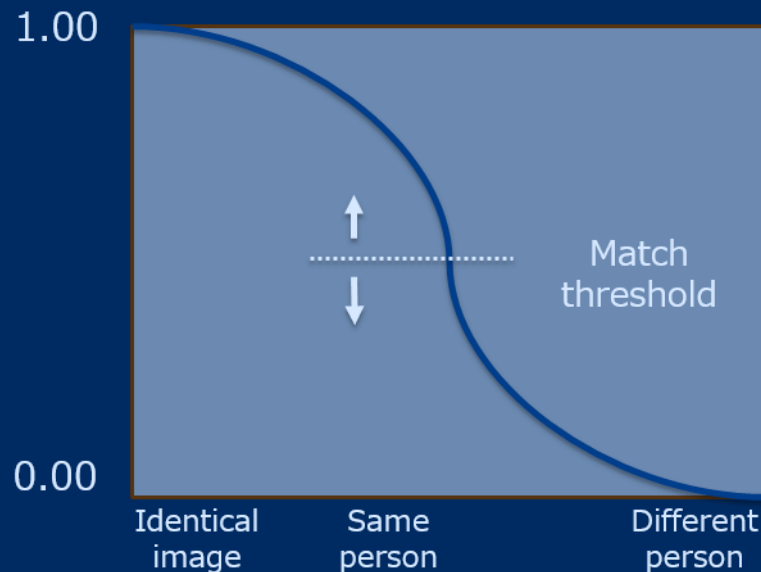


Extraction of multiple faces for search (adjudicate)



Obscured face, 0.61 match score

Match score: influencing factors



- Image quality
- Lighting
- Pose
- Expression
- Subject ageing
- Facial hair
- Head coverings

- More accurate algorithm
- Larger number of sampled images to increase chance of finding match above threshold



- Lower match threshold = higher probability of a real-time match
- But setting the threshold too low increases risk of false alarm
- Less accurate algorithms are more likely to generate false alarms

Enhanced
Technology

Enhanced Robustness Against Partial Occlusion

Find features of the face even in crowded environment when face is partially occluded



Crowded Environment
(Partial Occlusion)

Enhanced
Technology

Enhanced Deep Learning

Enable face comparison and matching with angled or low resolution (captured at a distance from a camera) images



Change in Angle



Far from Camera
(Low Resolution)

Neoface References



Brazil Airports: Real-Time Border Control Monitoring

- Face Recognition for customs
- Detect passengers tagged as “high risk” at customs clearance
- 14 Airports + 1 central site
- 66 Surveillance Cameras



Neoface References

Colombia: Medellin Atanasio Girardot Stadium



- To combat violent hooligans, all attendees are registered and photos entered into NeoFace Watch before entering the stadium
- Covers 40 entrances, halls and the grandstands
- 140 Surveillance Cameras



Neoface References



India: Lemon Tree Hotels

- Lemon Tree Hotels is India's fastest growing chain of upscale, midscale and economy hotels.
- Owns and operates 26 hotels in 15 cities.
- The customer experience plays a major role in the hospitality sector, as they get a significant amount of their business from repeat and referred customers.
- Lemon Tree uses Neoface® Watch Face Recognition to create a more positive and satisfactory experience for all their customers, while offering that additional "Special Service" to their VIP and members registered in their system.
- Situated in the upcoming Aerocity Hospitality District, in close proximity to the international airport, Lemon Tree Premier needed to have a top-end surveillance and security system.
- Two solutions in one:
 - VIP identification for hospitality
 - Unwanted detection for security



Neoface References



Cyprus: Merit Casinos

- Real-time surveillance looking for blacklisted players and whitelist VIPs
- During POC, NFW detected a blacklisted gambler
- Agreement signed for 10 casinos
- First casino deployed
- Other Cyprus casino chains now running POCs



Neoface References



Houston Airports System: Security Screening Wait Times

- HAS tested Bluetooth, Wifi and Face Recognition to understand passenger journey and queue times.
- Only NFW provided sufficient data points and auditability
(+75% sample rate NFW vs 3% for Bluetooth)
- Faces are captured, enrolled and matched anonymously.
- Faces are automatically removed from the system daily.
- Time of enrolment and subsequent match times provide journey and queue time information to monitor service levels and passenger travel times inside the airport.



Neoface References



U.K. High Street Retailer: Retail Fraud and Loss Prevention

- One of the UK's largest high-street retailers
- Have major problems with shrinkage, losing multiple millions in London alone from theft (Loss Prevention Team)
- A significant percentage of this theft comes from known offenders working as part of highly organized gangs
- Tried other vendors and found facial recognition was not working for them (around 17% hit rate)
- Tried NEC and saw the hit rate move to approximately 85%
- Currently in 25 stores in London, with a nationwide deployment planned.



Neoface References



U.K. Kings Cross Estate Open Spaces

- The challenge facing the Kings Cross Estate Security team is to recognise missing, suspect and wanted persons in the busy estate and alert then work with the MET Police upon positive match.
- A Neoface® Watch face recognition solution is installed in and around the Kings Cross Estate and monitors for a changeable list of “Known Persons Of Interest”.
- Technology: Neoface Watch, IP Full HD Cameras, Alerts, Matching and reporting. Future possible integration hooks to Milestone VMS for reviewing matches in the VMS front end.
- Fully deployed system by Fibre Technologies (NEC UK Partner).



Neoface References



South Wales Police - Champions League Final 2017

- Facial Recognition Solution for Champions League Final at Cardiff Stadium
- Solutions required
 - Events Team & Counter Terrorism Real Time Solution
 - Custody Suite Static Face Search and Video Importer Solution
 - Professional services
 - 2LM & 3LM Support
- Event date: Saturday 3rd June 2017
- Procurement Process: Open commercial tender
 - Awarded 28/3/17
 - Evaluation criterion: 80% Technical functionality, 20% Price



Access Control for Immigration & Checkpoints Authority (e-gates)

- Fiumicino
- Ciampino
- Napoli
- Bologna
- Firenze



Immigration control

- Rugged device immigrant pictures
- Pictures loaded inside DataBase
- 1:n investigation



Control Room

Hiperwall ®

Control Room



- Videosurveillance
- NOC / SOC
- Factory / Industrial
- Crisis management
- Territory control centers
- Research centers

Software Package

Output - Unlimited Number of Displays

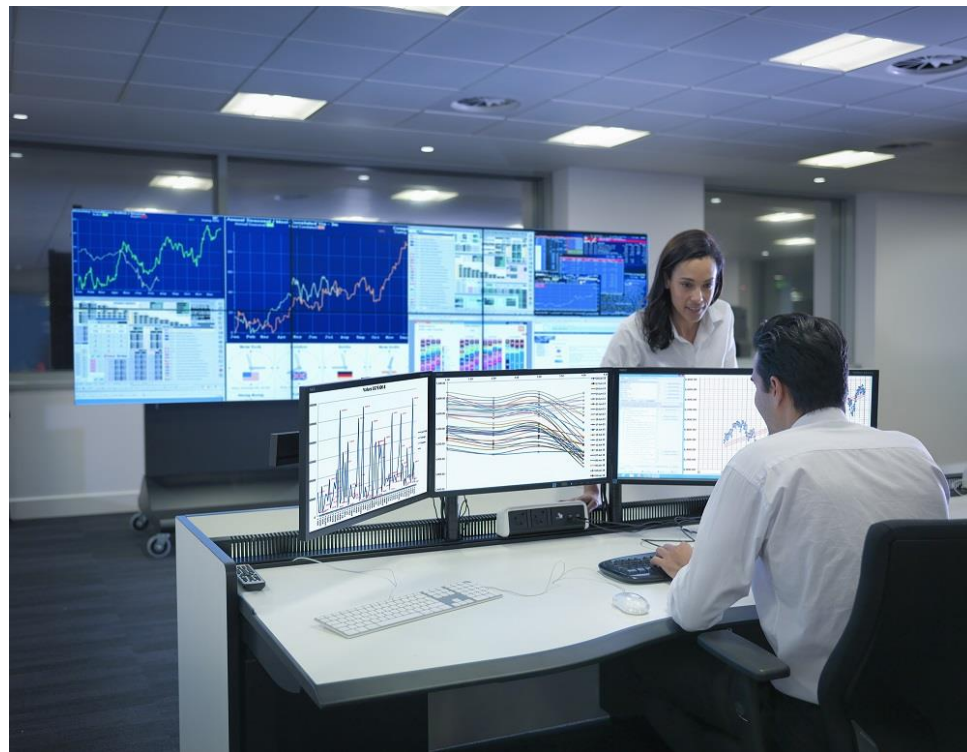
- Scalable in size of video walls
- Each display equipped with a PC & connected via defined network

Input – Infinite Number of Sources

- Source PCs also connected via Network
- Eliminates servers, matrix switches and distributors

Combinations of Different Content types

- High Resolution Images >1GB
- Videos & Streaming content including HD and 4K
- Static, Dynamic and Interactive PC applications



Hiperwall | Distributed System and Resolution

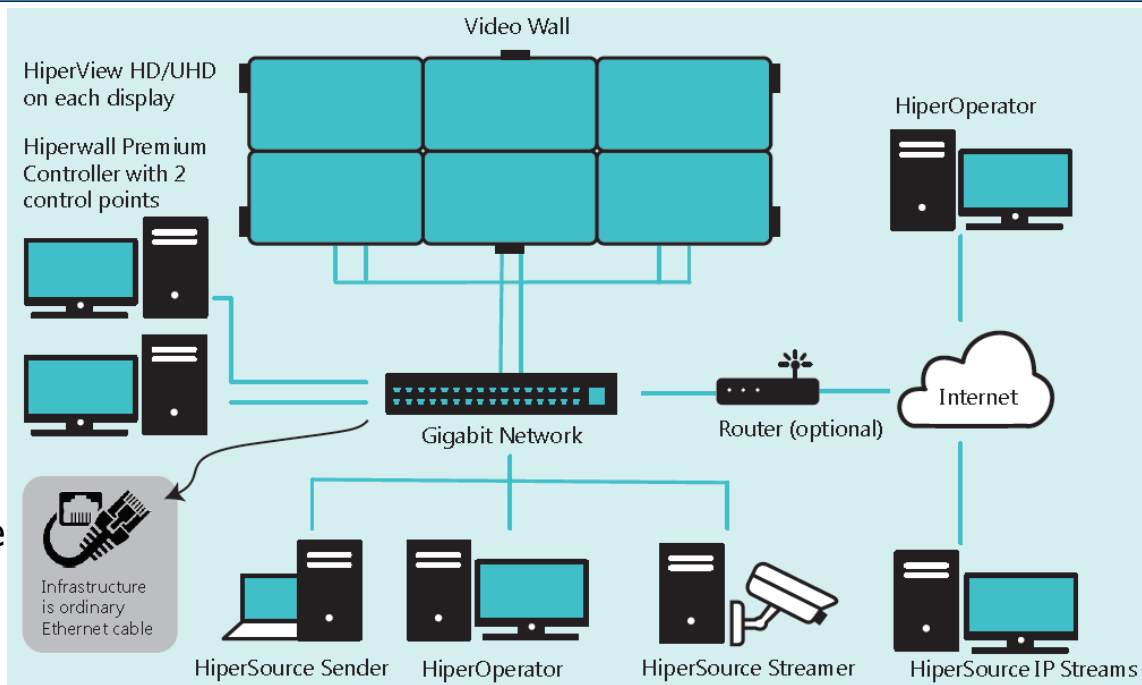
- Each display equipped with a Slot-in PC (OPS)
- Each display used with full native resolution
- Enabling total resolution of all displays – e.g. 4x3 video wall
 - Native Full HD Resolution per Display of 1920x1080: ~ 24 Megapixel



4x3 NEC Display Video Wall – 12x Slot-in PC connected via LAN

Hiperwall | Advantages

- Simple to integrate, install, configure & use
- Eliminates specialized video hardware
- Reduces cost, complexity, footprint
- Provides greatest configuration flexibility
- Eliminates scalability limitations
- Easy incremental expansion over time
- Cat 5/6 cabling: simpler to install, lower cost and longer length limits
- Distributed architecture
- Maintain performance for small or large deployments



Corporate Communication

Meeting rooms and Corporate Digital Signage

Meeting Rooms and Corporate Digital Signage



Internal security messages provided by meeting room and Corporate Digital Signage displays



 **Orchestrating** a brighter world

NEC