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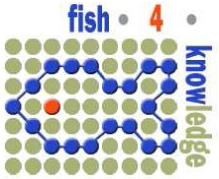
Integration and Evaluation

Bas Boom



Objectives

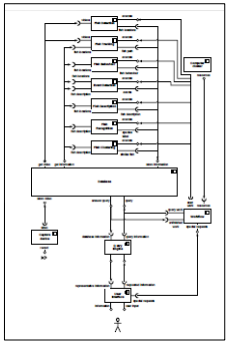
O5.1: Define component and datastructure that allows quick integration

O5.2: Evaluation that targets both Research and Marine Biology perspectives

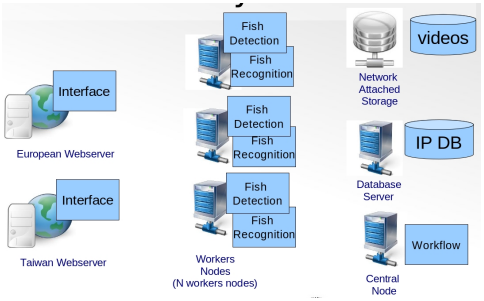
O5.3: Achieve successful integration

O5.4: Achieve successful evaluation

Outline

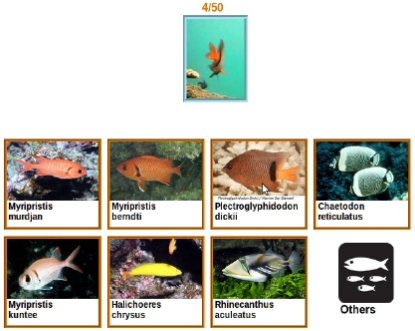


design



integration

processing



evaluation

Grand Design - Recap

Communication

- Component retrieves input from storage facilities
- Component saves output in storage facilities

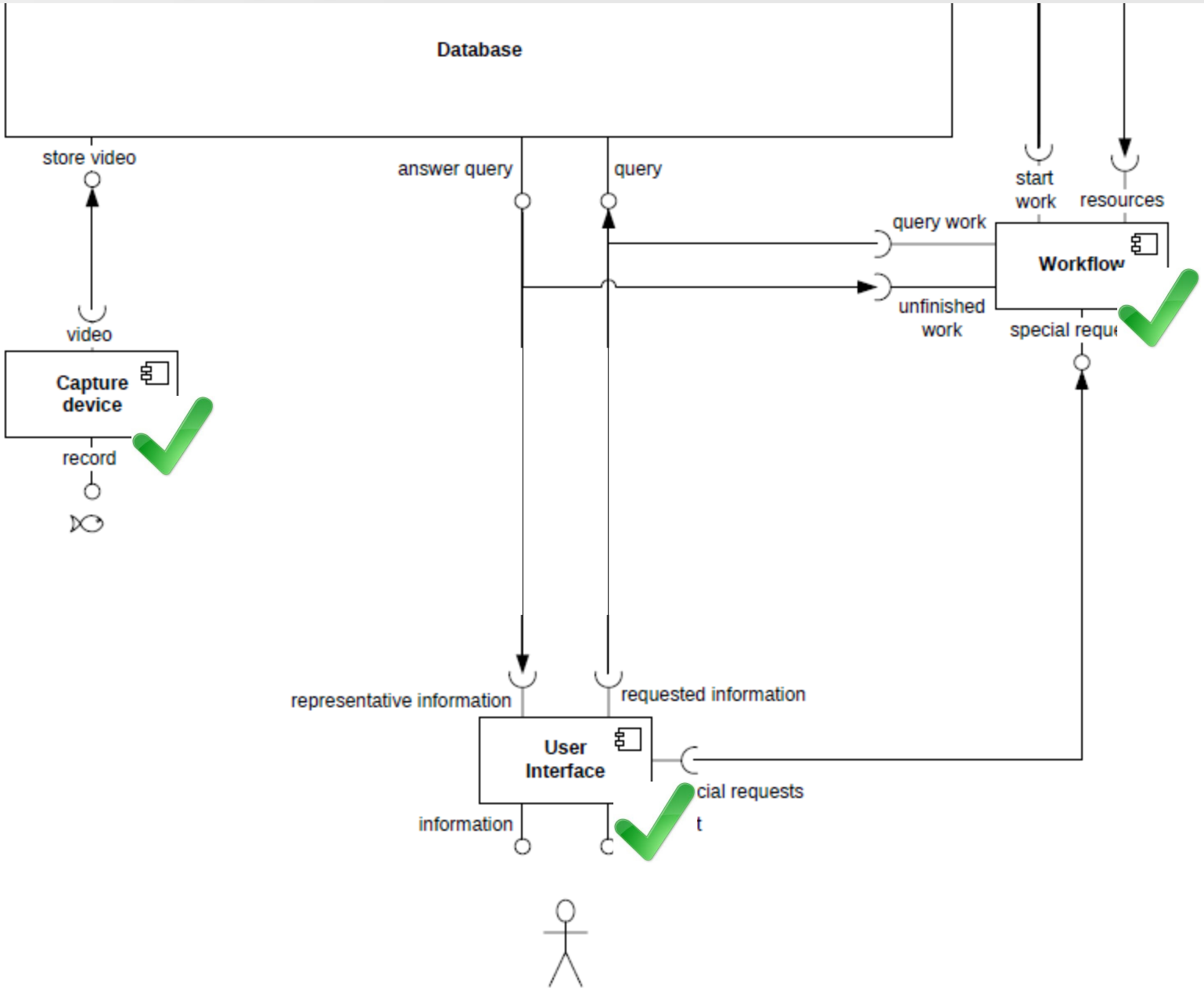
Storage Facilities

- Store all data (video, records, ontologies)
- Simple interface to query and store data
- Same Datastore Definitions use by everybody

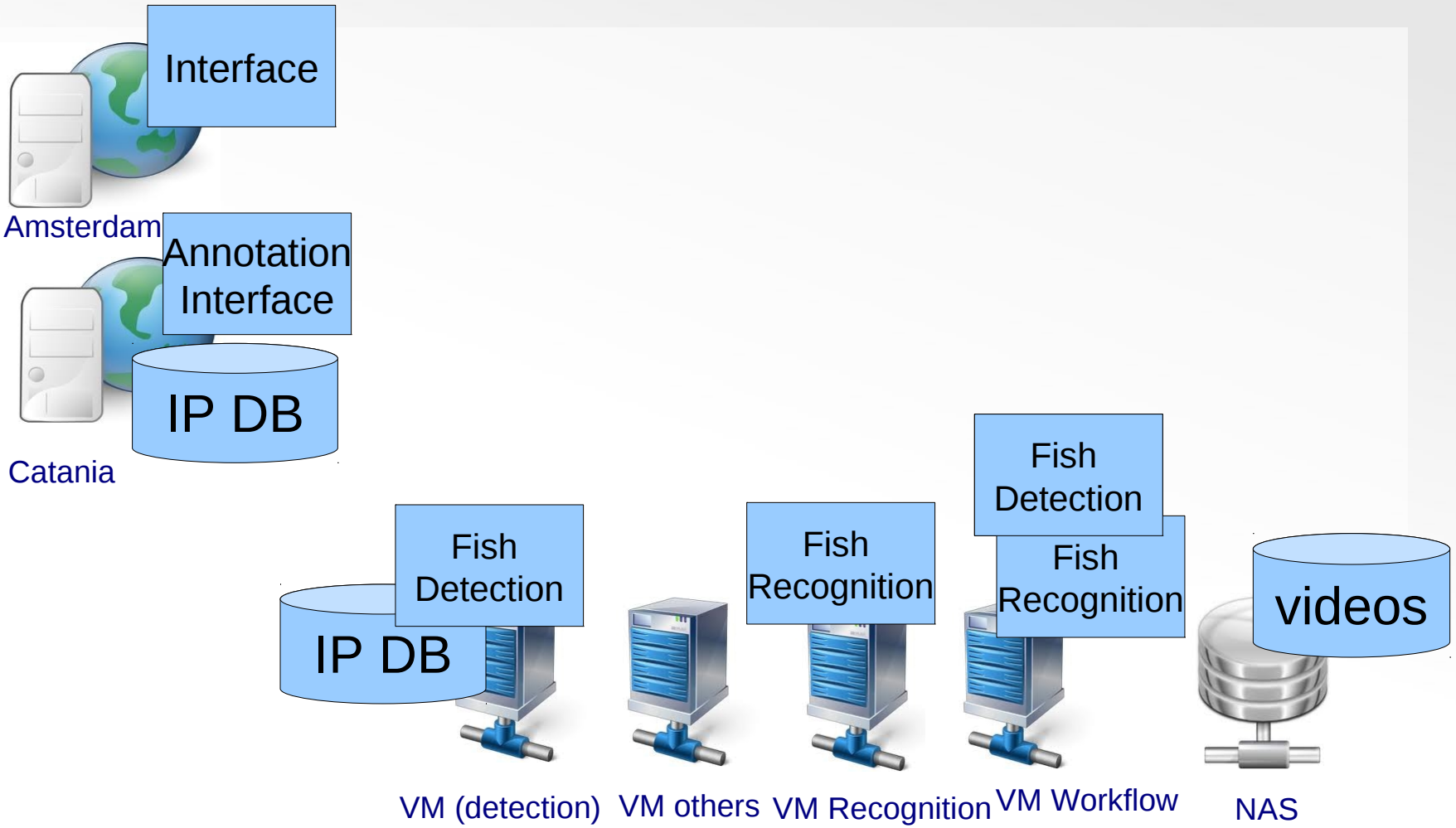
Engineer

videos
Fish Detectio
execute
ocations
videos
Fish Trackin
execute
fish locations
h path
Fish Behaviour
execute
fish locations
fish behaviour
Computer cluster
resou
fish locations
Event Detection
execute
fish description
events
Fish Descrip
execute
fish locations
h description
Fish Recognitio
execute
fish description
pecies
abel
Fish Clustering
execute
fish description
nilar fish
get video
get information
store information
Database

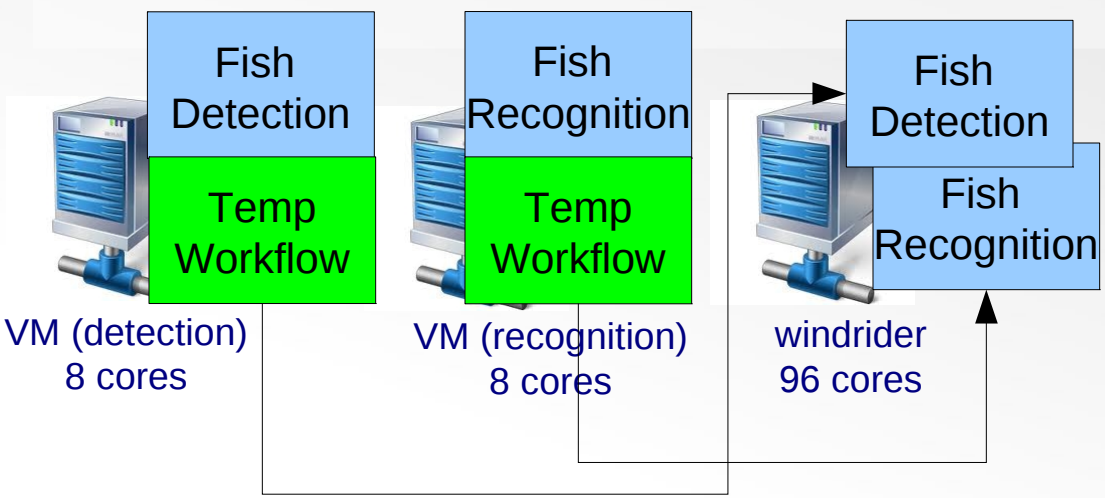
Engineer

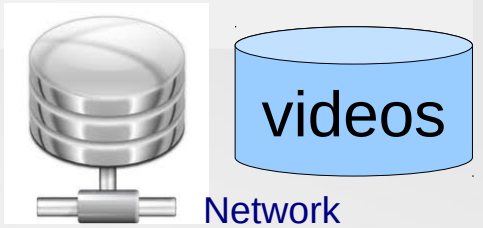

Database
store video
answer query
query
start work
resources
query work
Workflow
unfinished work
special requ
video
Capture device
record
representative information
requested information
User Interface
cial requests
t
information

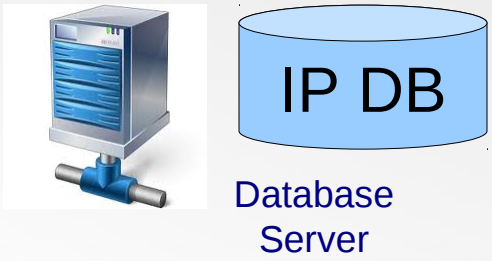
1st Year State

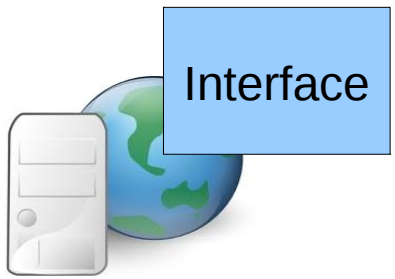


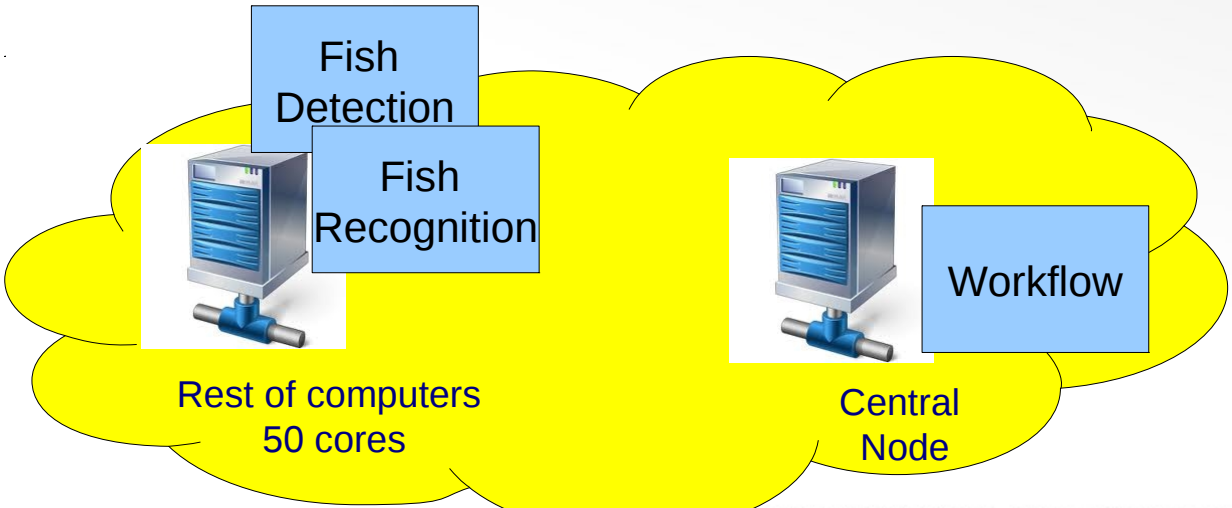
2nd Year State



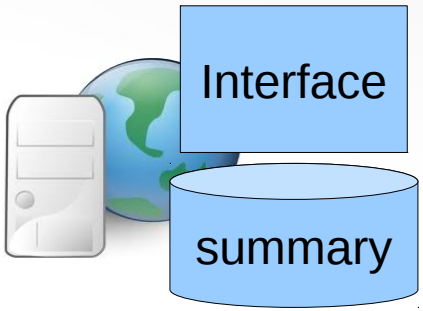




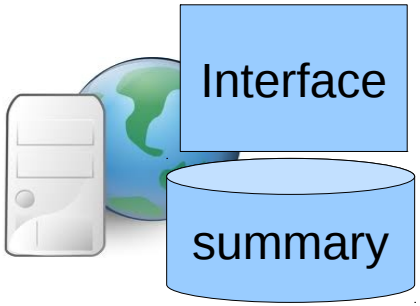




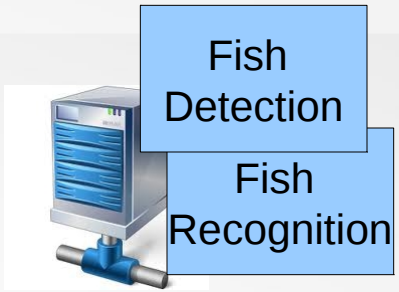
Current State

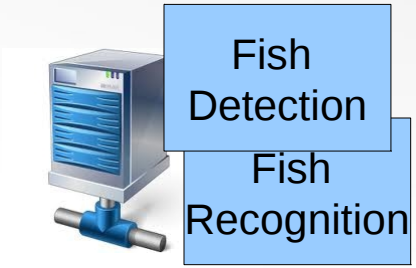


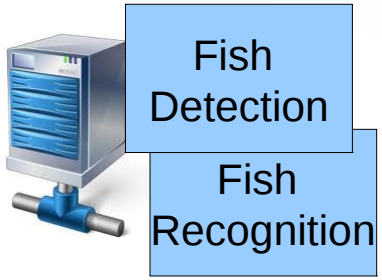
European Webserver



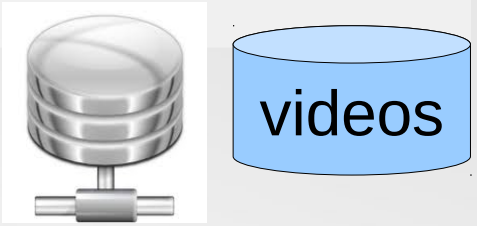
Taiwan Webserver



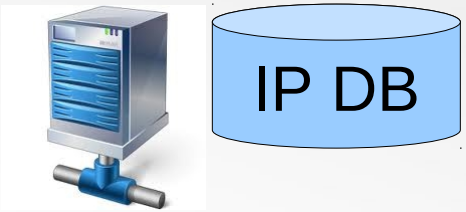




Workers Nodes
(N workers nodes)



Network Attached Storage



Database Server

Central Node

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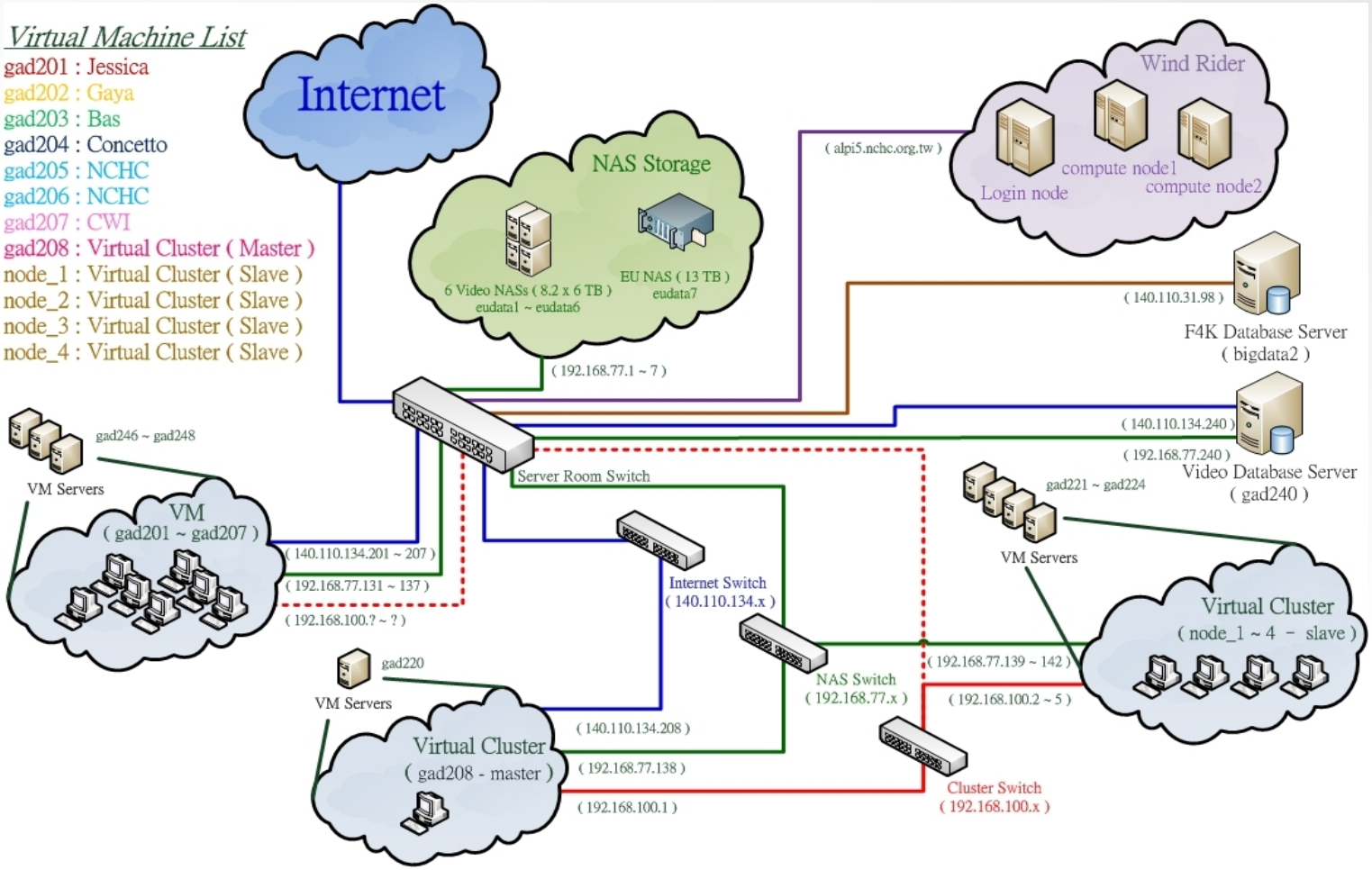
Network Diagram



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Integration Video

Data Processed

Measurement	Fish Detection (Oct 2012)	Fish Recog (Oct 2012)	Fish Detection (Oct 2013)	Fish Recog (Oct 2013)
Processed videos	44944 (8,5%)	18606 (3.5%)	530660 (100%)	271722 (51.4%)
Processed Normal videos			75806 (100%)	74906 (98.91%)
Fish Trajectories	6m	2m	124m	53m
Fish Detections	60m	19m	1445m	654m
Speed (10 minute video)	40 min (std 83 min)	175 (std 381 min)	12 min (std 12 min)	160 min (std 246 min)

Main tables

Table Name	Row count	Physical Size	Note
fish detection	1445.41M	322.26G	Abstracted information for each detected object
fish species	663.93M	24.67G	Correlated of fish object to species catalog
fish	124.28M	21.01G	Abstracted information of tracked fish objects
traj species	97.29M	3.58G	Correlated tracking trajectory to species catalog
frame class	11.61M	2.65G	Classification of video quality detailed to frames
fish species cert	32.55M	1.29G	Summary of det/rec certainty
summary camera 39	7.13M	1.24G	Aggregation of information on camera id
summary camera 46	“	“	
video	0.63M	0.14G	
processed videos	0.78M	0.12G	

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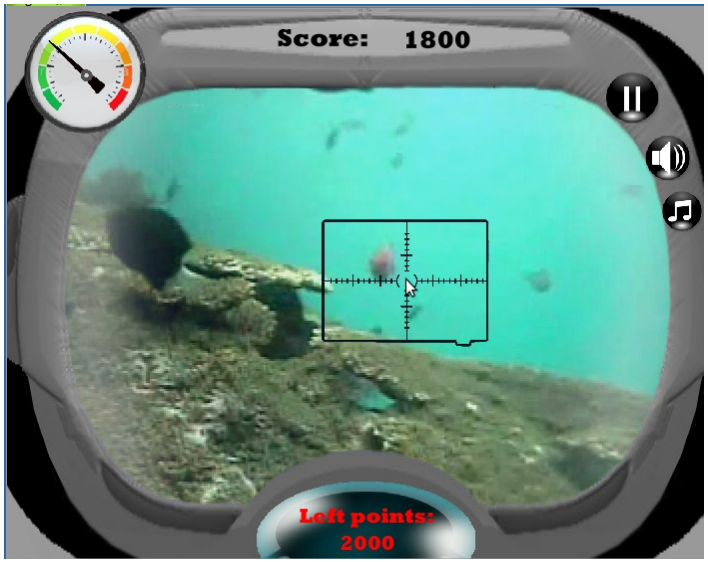
Supporting Evaluation

- Evaluation of the computer vision data using Ground-Truth Annotation:
  - Fish Detection/Segmentation
  - Fish Recognition
  - Recognition of unknown species
  - Fish Behaviour

Interfaces for annotation:

Fish Game

Fish Detection: locating the fish in the video frames (available at facebook)



80 users

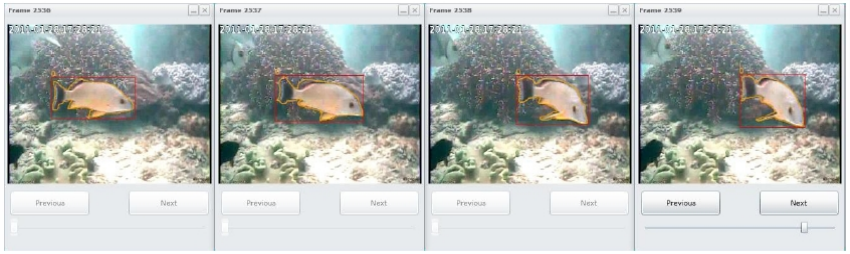
1300 game sessions

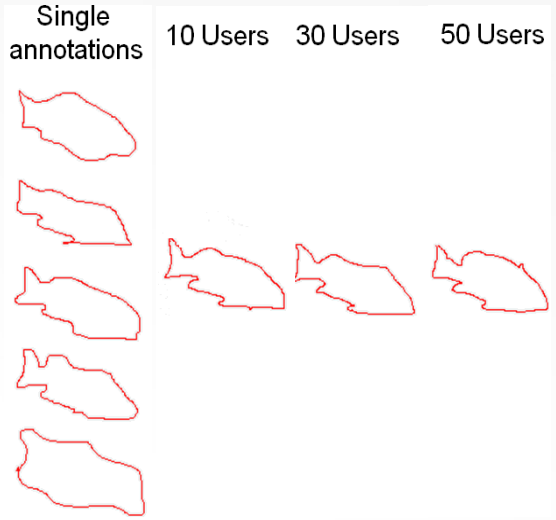
>260K clicks

Perla

Object Detection:

Webinterface for accurate segmentation of fish and objects





50 users, 35 videos, 13000 objects

63000 annotations

Automatic Clustering Support

- Fish Recognition: Webinterface for annotation of fish species

Subset is filter for

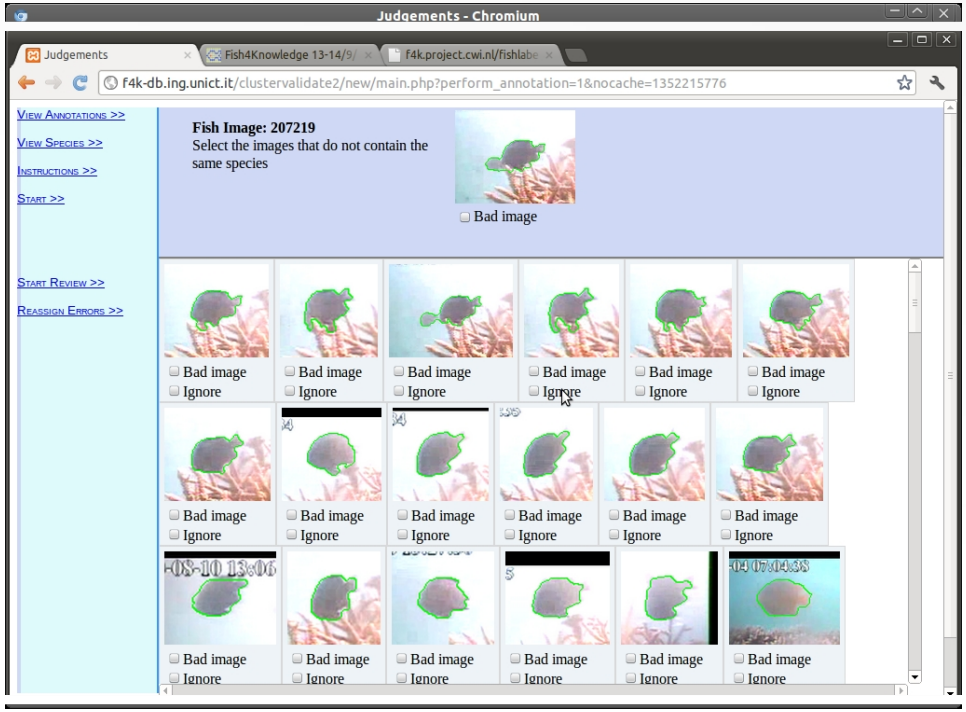
5 most common

Species

40 users, 1800 videos,

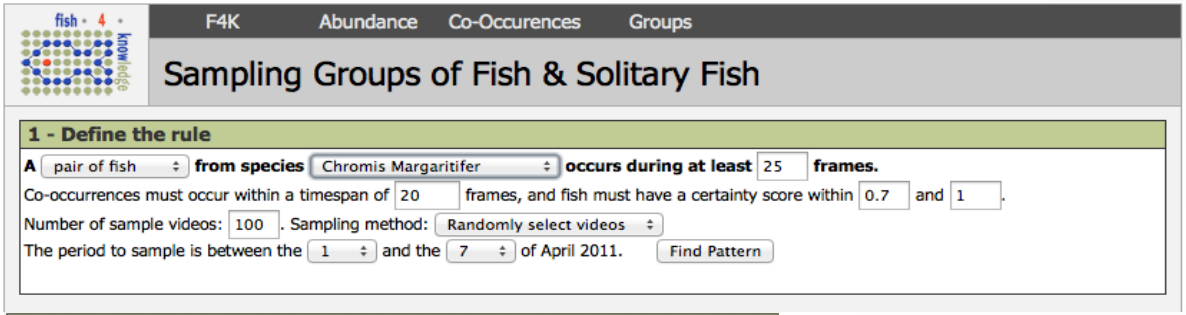
90275 objects

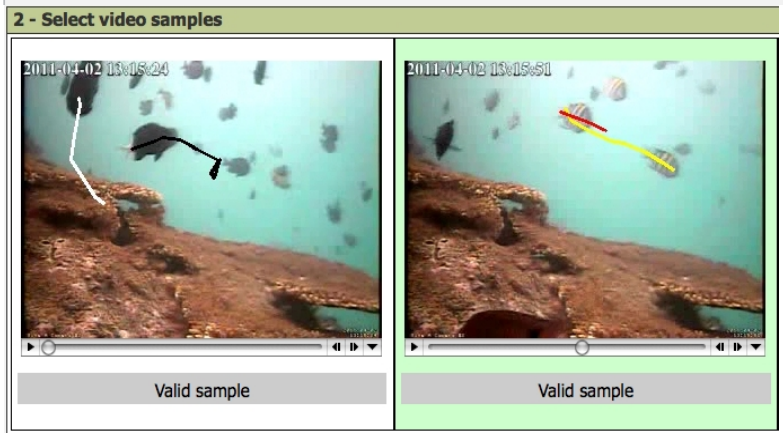
516,088 annotations



Fish behaviour retrieval

Web interface for retrieving fish behaviour patterns based on fish co-occurrence: group, solo, pairing





1567 events annotated

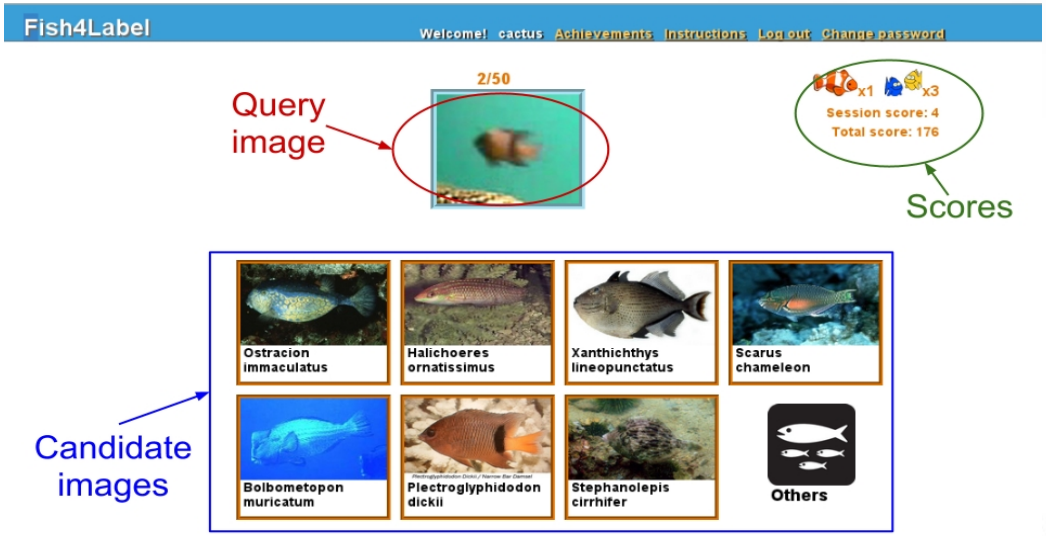
Fish Recognition Game

More refined labeling

e.g., New species, ``unknown" species, images with high disagreement

Entertainment as incentives:

Users get feedback from the system



Evaluation

Evaluation of separate components is already discussed:

- User Interface: Usability Studies

Confidence	All Answers(%)		No Usability Issues (%)		With Usability Issues (%)	
	Right	Wrong	Right	Wrong	Right	Wrong
Very High	86 (43)	19 (9.5)	69 (**48.3**)	12 (8.4)	17(**29.8**)	7 (12.3)
High	55 (27.5)	10 (5)	40 (28)	8 (5.6)	14 (24.6)	3 (5.3)
Moderate	16 (8)	5 (2.5)	8 (5.6)	0 (**0**)	6 (10.5)	6 (**10.5**)
Low	1 (0.5)	6 (3)	1 (0.7)	4 (2.8)	0 (0)	3 (5.3)
Very Low	1 (0.5)	1 (0.5)	0 (0)	1 (0.7)	0 (0)	1 (1.8)
Total	159 (79.5%)	41 (20.5%)	118 (82.6 %)	25 (17.5 %)	37 (64.8 %)	20 (35.2 %)

- Data processing:

  100% processed by fish detection

  52% processed by fish recognition

Fish Video for Biologists

- unknown object: 624
- Dascyllus Reticulatus: 1725
- Chromis Margaritifer: 2
- Plectrogly-Phidodon dickii: 64
- Acanthurus nigrofuscus: 43
- Scolopsis Bilineate: 37
- Amphiprion Clarkii: 10
- Hemigymnus fasciatus : 1
- Abudefduf vaigiensis: 4
- Neoglyphidodon nigroris: 2
- total (without unknown objects): 2512
- total (without unknown objects): 1888

Conclusion

Integration of the Entire System achieved

Massive number of videos processed
(45287 hours = 1886 days) with all software

Information accessible to marine ecology community

Strong system design which resulted rapid/flexible software development

Scientific Innovations

Entire System will appear in Ecological Informatics, allowing marine ecology new methodologies for their studies

Probably the biggest public analyses video dataset in science at the moment (different interesting annotated subsets, ImageCLEF)

Development of GroundTruth annotation tools (trade off between obtain information and accuracy)

Questions/Discussion

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