

# Software Components for Serious Game Development

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## Software Components for Serious Game Development

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ECSEL 2016, Pilsen

Co-funded by the Horizon 2020 Framework Programme of the European Union

## Starting points

- Applied games (serious games) are useful
  - Social problems, health, education/training
  - Driving creativity and innovation
  - Creating jobs
- Applied games are typically "low budget, low tech" ("poor cousins" of the leisure game industry)
- Applied game industry is highly fragmented
  - >3000 small companies across Europe;
  - no key players
  - Limited knowledge sharing
  - Plenty of re-inventing the wheel



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## The RAGE project

- H2020 Research and Innovation Action in advanced gaming technologies (ICT-21)
- Partners from
  - Games Industry
  - Research
  - Education and Training
  - Business Innovation



➡ To support (serious) game studios with new technologies ⬅

**Making available advanced game technology components to develop Applied Games easier, faster and more cost-effectively.**

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## RAGE reusable game software components



<p><b>1 Data analysis</b></p> <ul style="list-style-type: none"> <li>Data capturing</li> <li>Sensors</li> <li>Emotion detection</li> <li>Competences</li> <li>Learning analytics</li> <li>Assessment</li> <li>Evaluation</li> </ul>	<p><b>2 Game intelligence</b></p> <ul style="list-style-type: none"> <li>Social agents</li> <li>Natural language</li> <li>Dialogues</li> <li>Game balancing</li> <li>Storytelling</li> <li>Procedural animation</li> <li>Gamification</li> </ul>
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## What new technologies?



WP3 User data analysis	WP3 Strategic and Social Agency
Server-Side Interaction Storage and Analytics	Emotional Appraisal
Step-based competence assessment	Emotional Decision Making
Readiness - Self-rated Analysis on Teams	Social Inference Dynamics
Authenticity & Attribution	Virtual Human Controller
Server-side Identification & Analysis	Role-imp. Controller
Game Storage - Server-Side	Integrated Authoring Tool
Client Tracker	Readiness - Semantic Models and Topic Mining
Demand Model Asset	Readiness - Automated Essay Grading
Competence Assessment Asset	Readiness - Automated Assessment of Participation and Collaboration in CSCW Conversations
Motivation Assessment Asset	Readiness - Automated Identification of Reading Strategies
Real-Time Anomaly Detection Using Gaussian Mixture Regression	Communication Systems Editor
Game Storage - Client-Side	Speech I/O
Game-Side Real-Time Emotion Recognition	Adaptation and Assessment (DAPS) Asset
	Competence-based Adaptation Asset
	Motivation-based Adaptation Asset
	Player Profiling Asset
	Cognitive Interaction Asset
	Player Center Rule and Pattern-based Adaptation
	Social Classification Assets (SLGAR)

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## Rageproject.eu



Software assets inventory

Asset name	Short description	More details
1 Server-side interaction storage/analysis	Module to store server-side interaction data (implementation of a data collection and storage service, including authentication and access control) for storage of interaction data.	View
2 Step-based competence assessment	Module to store step-based assessment of participant skills. Step-based competences, which change progressively during the game, are stored in a database. It includes a dashboard that the project steering team can use to monitor the progress of assessment.	View
3 Readiness - Semantic Analysis	System to analyze and generate topic models. Analyzes text to extract topic tags. Designed for identification of topic-related interactions, such as posts, tweets, or messages.	View
4 Authentication & Attribution	Module to store authenticating data, which is used to identify and track user activity. Includes an engine, server-side logic to track user and role identity, checks, and a client-side logic to log user data.	View
5 Game Storage, Server-Side	Module to store game-related data or content on server and access of data on client. Part of the server architecture and logic, and user access, ready to use in the game.	View

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## Coping with technological diversity



WIKIPEDIA: List of game engines

GameSalad

unity

COCOS2D

MONKEYENGINE

DX Studio

Xamarin

GameMaker Studio

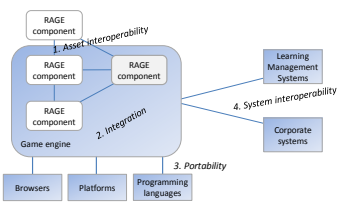
CRYENGINE

TORQUE

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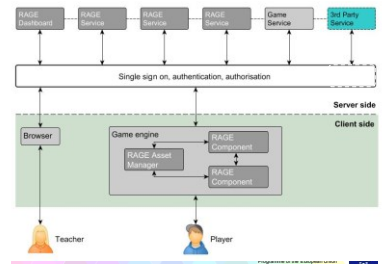
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## Portability/Interoperability

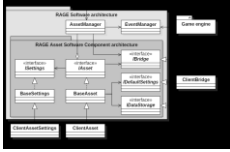


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### RAGE Client-asset architecture



- Avoids dependencies of external software frameworks/libraries
- Based on established software patterns and abstraction
- Avoids any interference with the user-interface
- Principal client-side code bases: C# and TypeScript

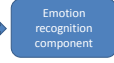
### Examples

- Emotion recognition
- Natural language processing
- Performance statistics
- ....

### Example 1: Real-time emotion recognition



Webcam stream

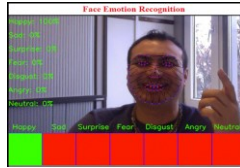


- Happiness
- Sadness
- Angriness
- Disgust
- Surprise
- Fear
- Neutral

### Example 1: Real-time emotion recognition

1. Face detection
2. Facial landmarks (37-64 points)
3. Emotion extraction
  - training data set
  - fuzzy logic rules
  - accuracy ~80%

### Example 1: Real-time emotion recognition



### Communication training



### Job seekers interview training



### Example 2: Natural language processing

- I cannot speak English
- I can speak English
- I can speak Dutch

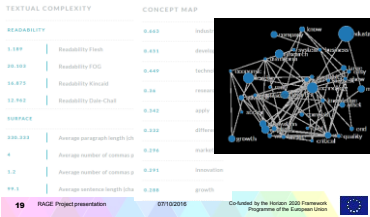


### Example 2: Natural language processing

- RAGE readerbench services (RESTful)
  - Textual cohesion
  - Textual complexity
  - Semantic annotation
  - Sentiment analysis / opinion mining
  - Essay grading
  - Conversation analysis
- Readerbench.com (English, French) → ....Dutch



### Example 2: Natural language processing



### IT ALERT



### Example 3: performance statistics



Exploiting the players data trails:

- Which data to select?
- Which statistical procedures to use?
- How to apply and interpret the statistics?

Performance indicators:

- Task completion time
- Task performance quality

- Population statistics
- Normality check
- F-test/T-test comparisons

### Example 3: performance statistics



- Goal:
  - provide teachers with reliable statistics on student performance in serious games and protect teachers against making interpretation mistakes
- Approach:
  - Send student scores from a client side game to a server-side analytics system
  - Compare student scores to group scores
  - Present visualizations of performance when requested by the teacher
- Interpretation:
  - Include interpretation info and possibly a warning for misinterpretations

### Example performance visualization

