

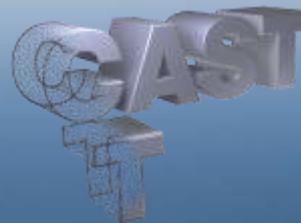
2nd IFIP Working Conference on Computer Aided Innovation

**Collaboration in automotive
winter testing - Real-time simulations
boosting innovation opportunities**

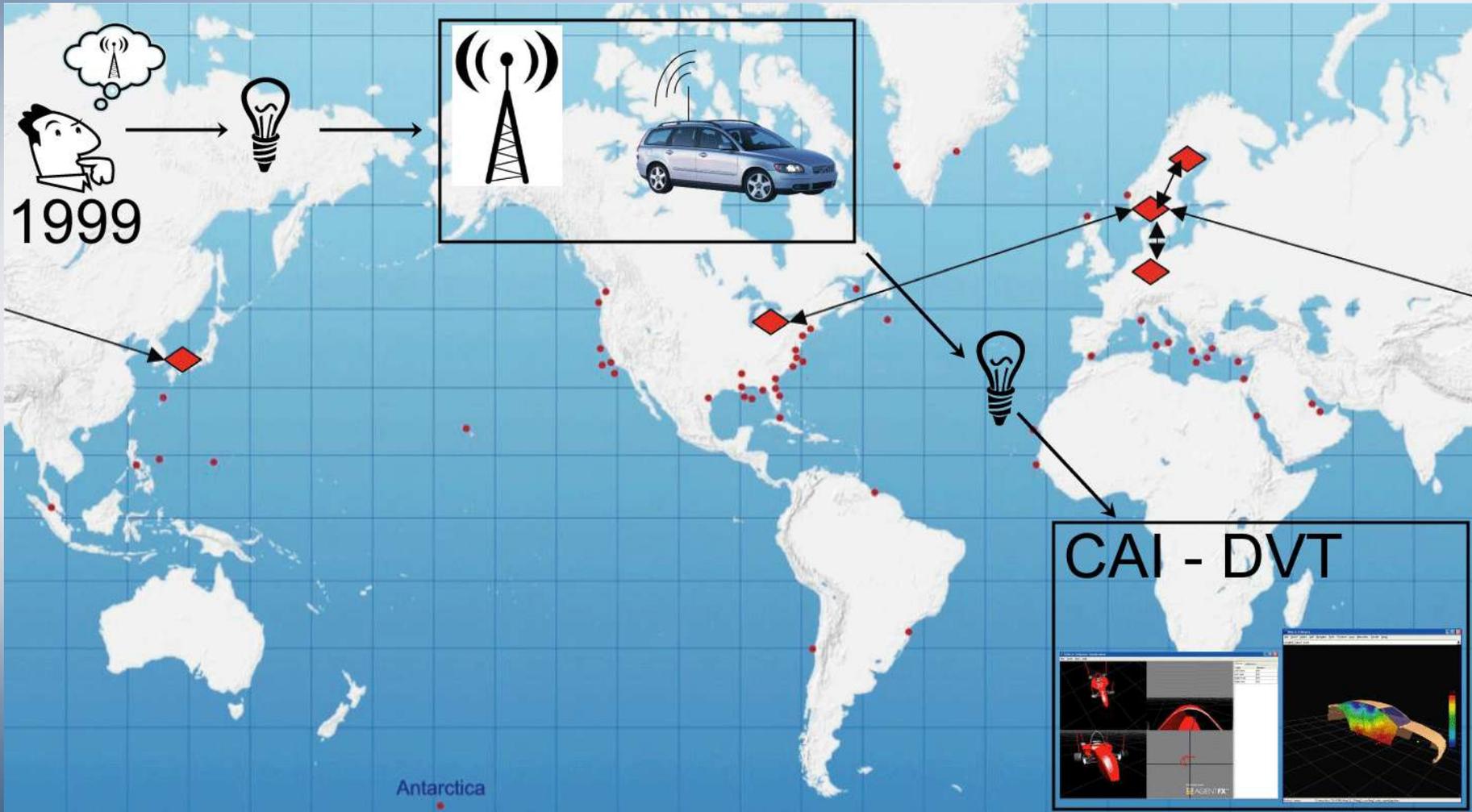
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Innovation process



Swedish proving ground

- Cold weather !
- Secrecy !
- Many kilometers of low traffic public roads and lakes with ice tracks
- Knowledge of winter testing since 1967
- Total turnover of \$77 million/year.
- 11 Test entrepreneurs'



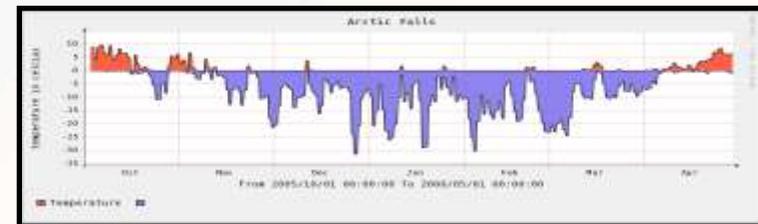
Thoughts from the actors – Entrepreneurs

- The entrepreneurs perceive the **transportations of cars** from other parts of the European Union **as easy**, but they also consider the **poor travel possibilities for people** (flights and long distance to the testing area) as a negative aspect.
- In a future perspective of five years, the entrepreneurs believe that **they will probably sell more services** and that the OEMs will join and share test facilities.
- One winter test season only about four months.
 - They **hope that there will be summer testing** and that the test activities will continue to positively develop.



Automotive industry

- OEM reduce the number of suppliers but increases the collaboration with them.
- It is costly to send engineers to the north of Sweden.
- Test season only four months.
- Amount of software in a premium car is about 100MB of binary code.



```
a rcv = template
interval := 100ms
timer = before 5ms action
        rcv.ping
        after interval
        timer

return {
    set t = action
        interval := t
    start = timer
}
```



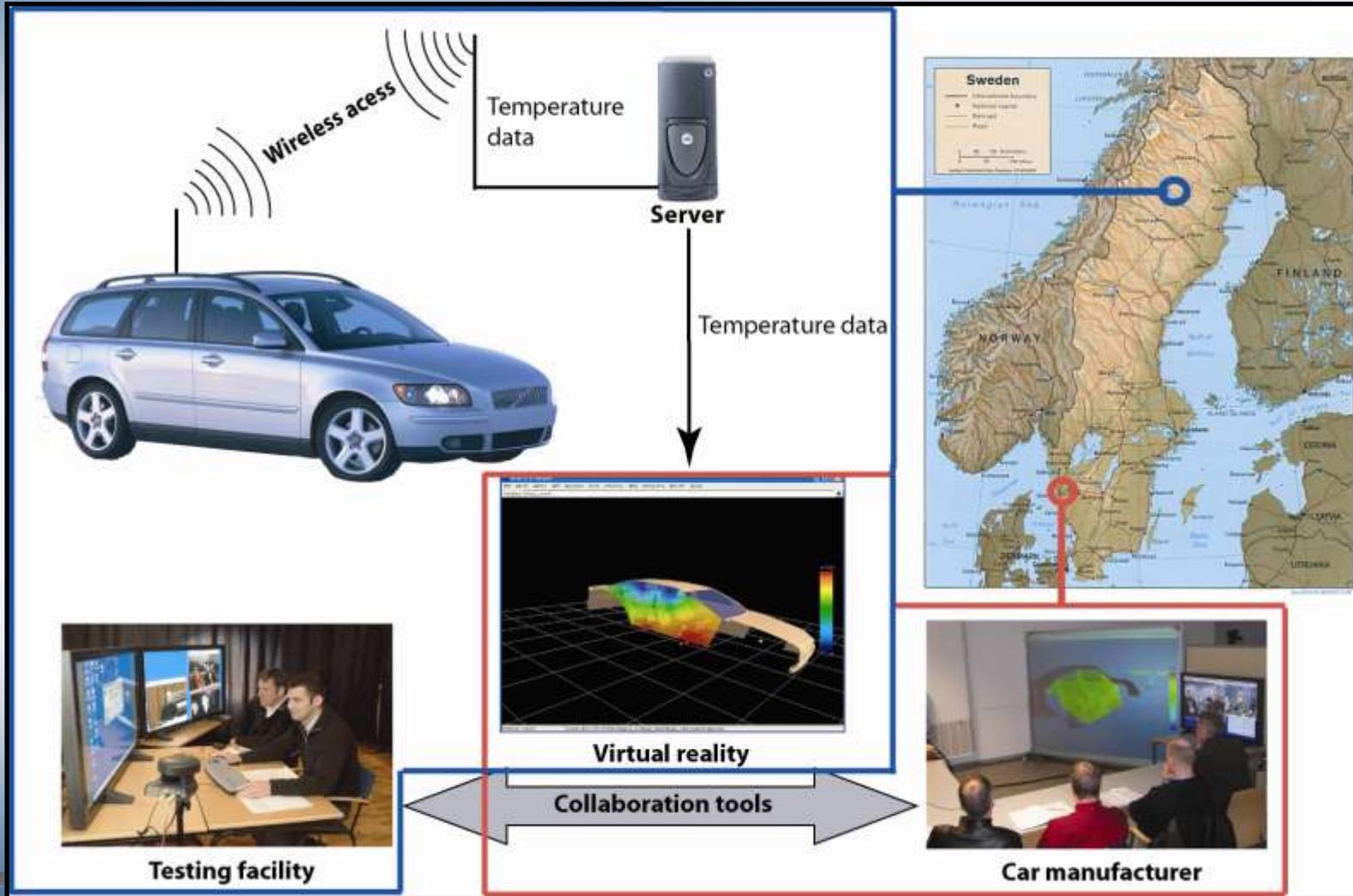
Thoughts from the actors – OEM and Tier 1

- *“I believe that the tests will be standardized with well-defined methods, which in turn will reduce the number of people needed for the test. With good methods for performing winter testing, I also believe that the tests could be outsourced to the entrepreneur. This will reduce the costs.”*
- *“...life length test for a longer period and in turn reduce costs and get more value from the test season.”*



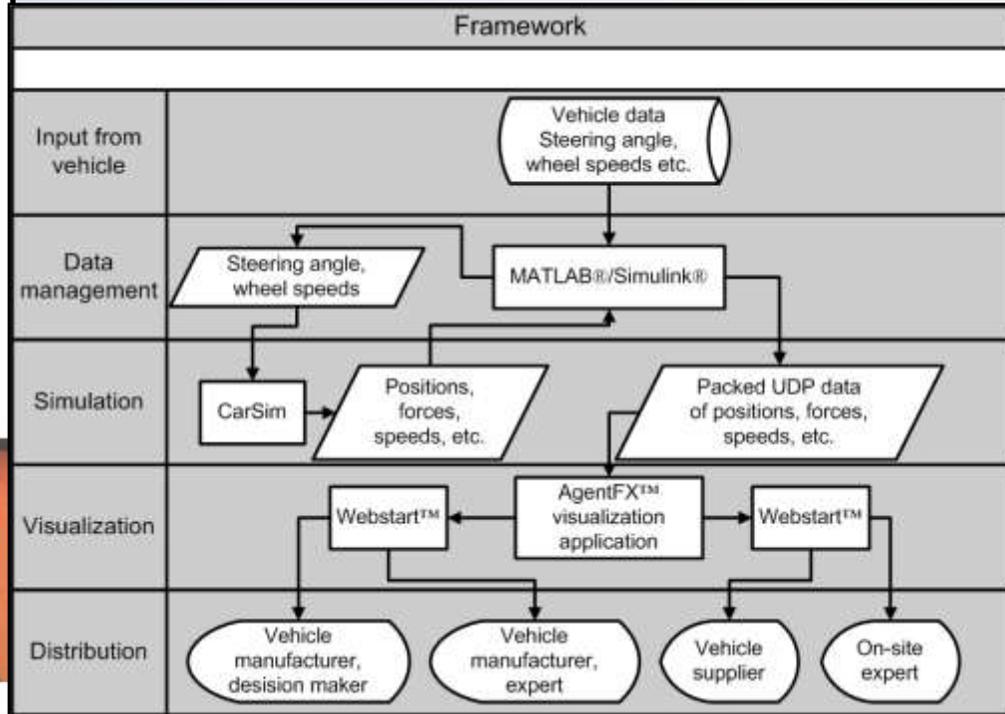
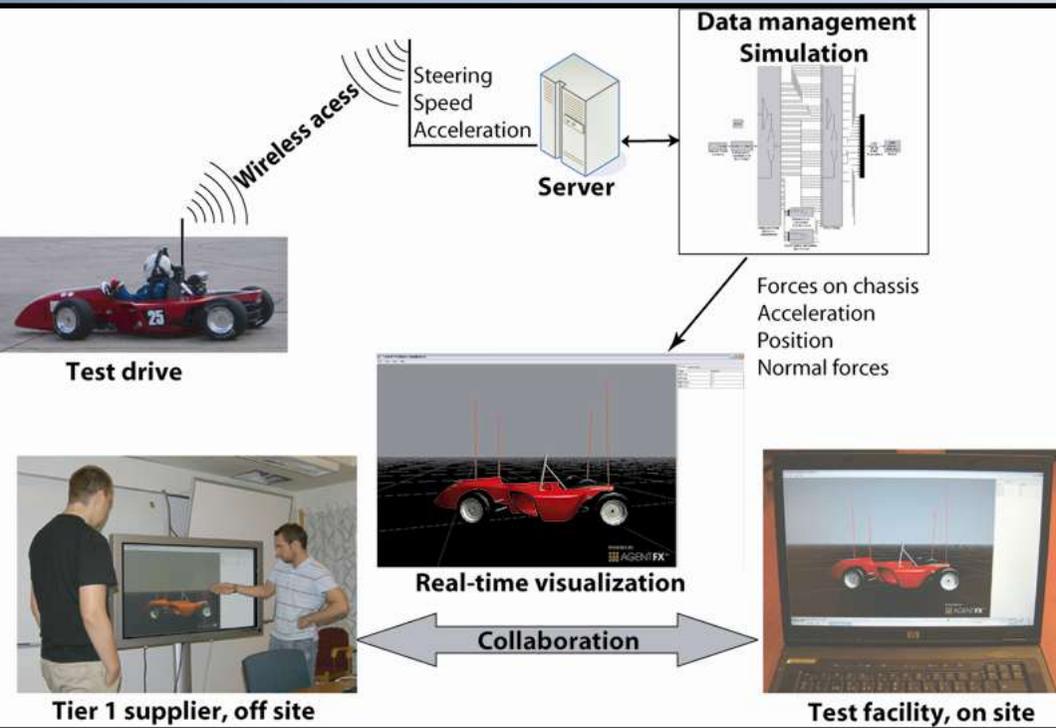


Past work



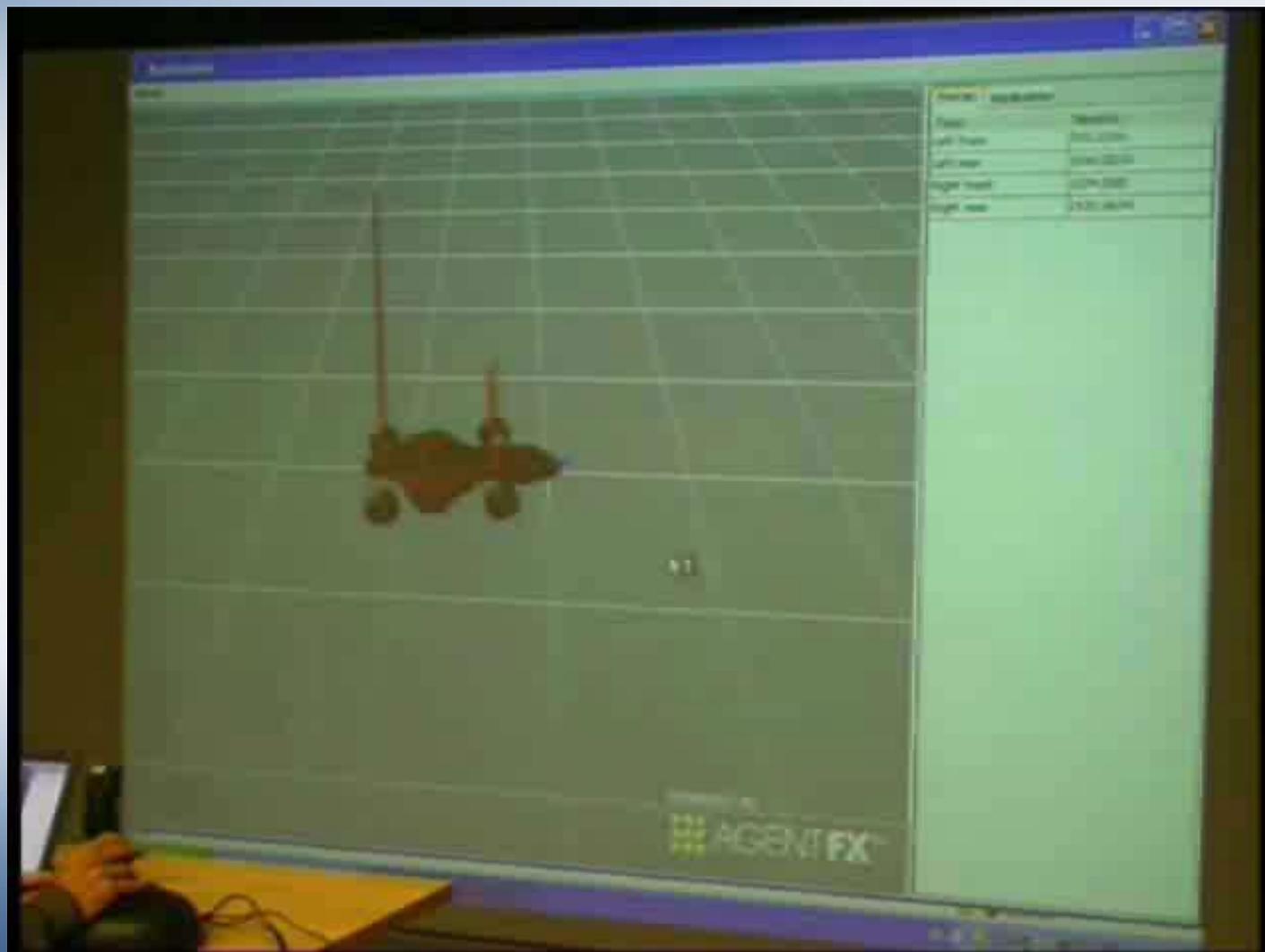


Present work





How it works...





Visualization of vehicle and its systems

Vehicle Validation Visualization

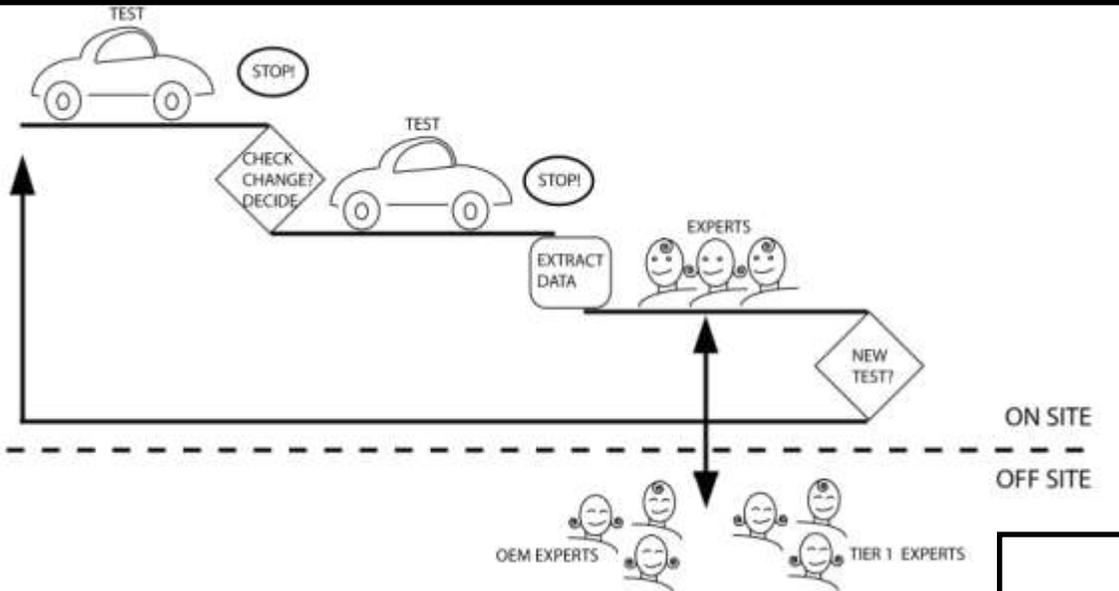
File Tools View Help

Forces	
Application	
Type	Newton
Left front	0.0
Left rear	0.0
Right front	0.0
Right rear	0.0

POWERED BY:
 AGENT FX™

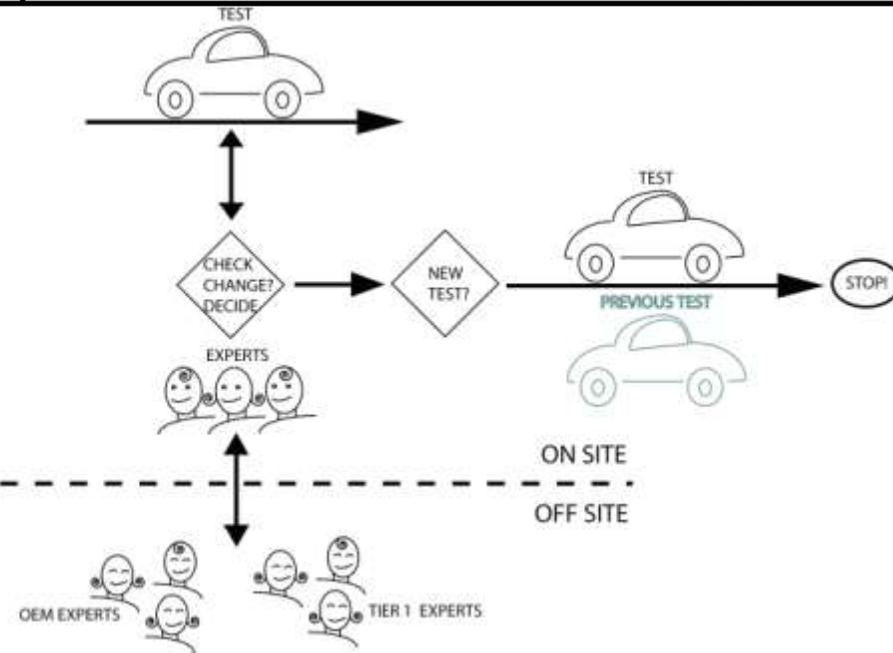


The processes



- From sequential and local...

- ...to concurrent and global



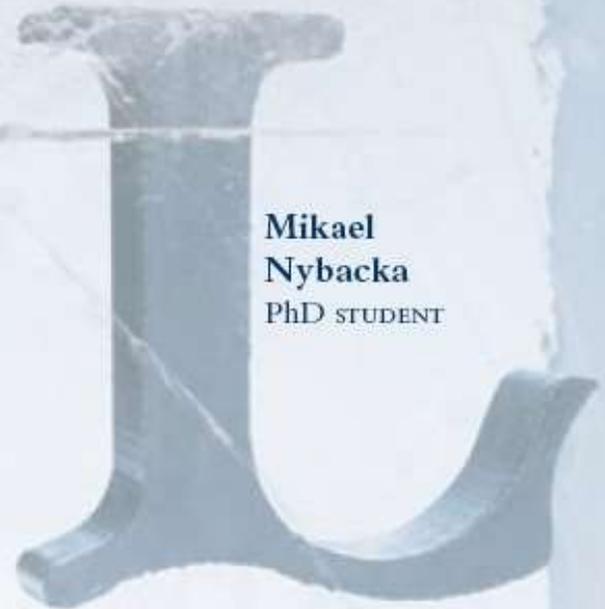
Continuous work

- Build up the framework with the dynamic simulation software CarSim
- Validate the vehicle model at MSC the following 7 weeks
- Build a web-based collaborative environment, combined effort in CASTT
- Find collaboration partner to test and validate the framework in real life setting with a real car, next winter.
- Further case studies and meeting will be performed to further map the needs and future thoughts of the OEM, Tier 1 suppliers and entrepreneurs concerning Distributed Vehicle Testing



Thank you!

PRODUCT DEVELOPMENT



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Great ideas grow better below zero!

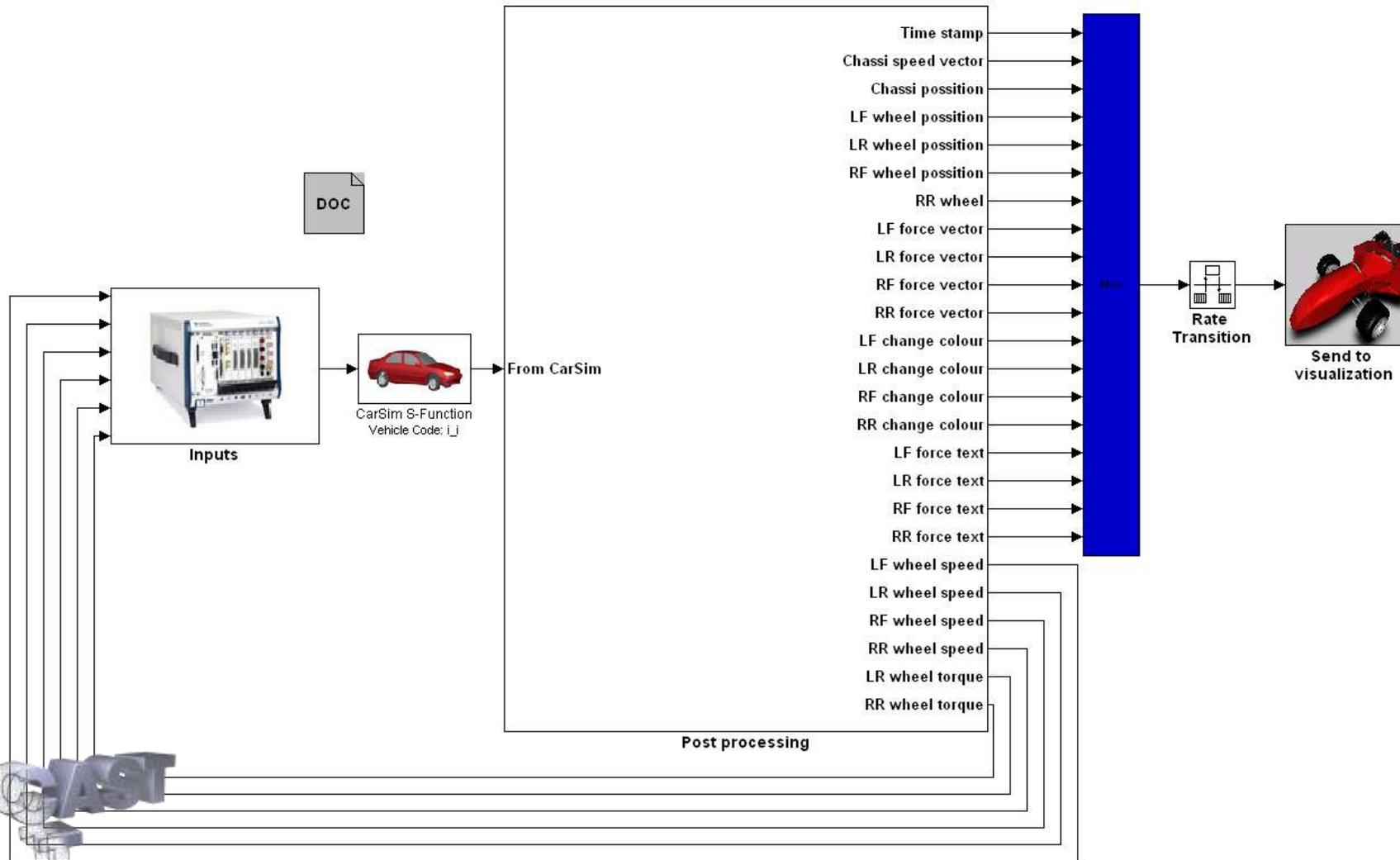


Functional Product Innovation

A framework for the plausible to-be scenario is found within a Functional Product Innovation (FPI) vision. **The vision is a joint academic and industrial construct to capture a widening in view among manufacturing companies**, the view widens from focusing mainly on the physical artifact to also entail a view on product development **where the performance of the physical product is provided as a service**. The goal is to take cross-company knowledge domains of engineering, business and production into account in the design phases. **This vision puts an emphasis on additional knowledge and information in early design phases, for example understanding of the actual use of the product and the environment where it is going to be used is important**, since these aspects needs to be designed into the final product.

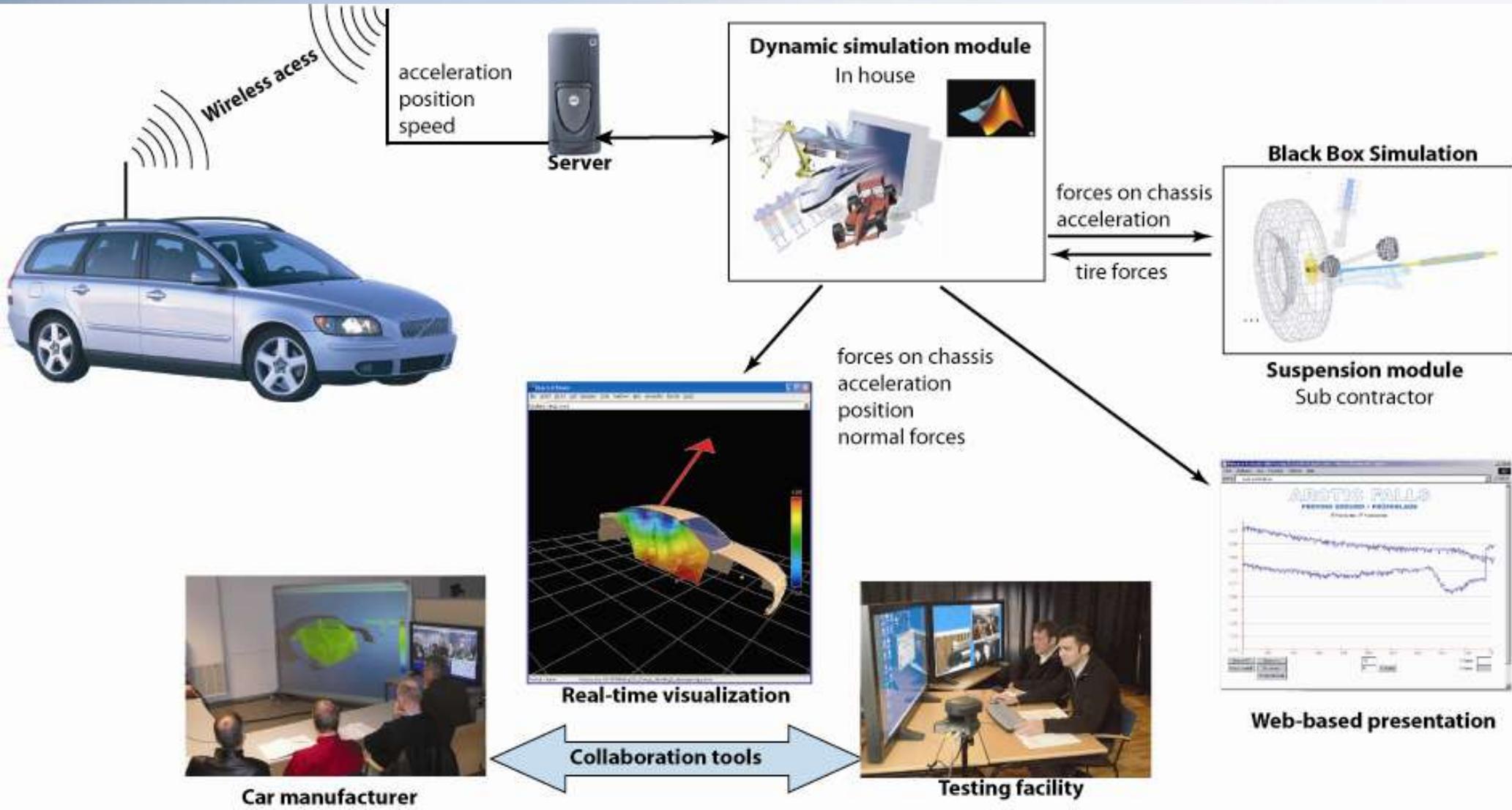


Data management





Black-box simulation added







CASTT real time measurement data distribution and visualization for collaborative analysis

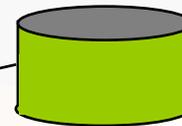


Test vehicle

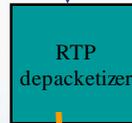
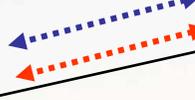
measurement data



Takes raw measurement data stream and encapsulates data in RTP packets



database: audio, video + measurement data (synchronized)



— RTP video & audio streams
— streams

Vehicle dynamics

Multi-body simulation (MBS) is used to simulate rigid bodies, movement, forces, etc., when connected to different joints or force elements like springs and dampers. More specialized MBS software for simulation of vehicle dynamics are listed below:

- *VI-Car RealTime, from VI-Grade [24]*
- *CarSim™, from Mechanical Simulation [25]*
- *CarMaker®, from IPG Automotive [26]*
- *DYNAware, from Tesis Group [27]*
- *ASM, from dSPACE [28]*
- *VDMS with MATLAB®/Simulink®, from Milliken Research Associates and Mathworks [29]*
- *Etc.*