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# Integrating the DIS Standards Into a Fully-Immersive Simulation Application

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THE UNIVERSITY  
OF  
LOUISIANA  
*L a f a y e t t e*

# Summary

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A practical solution to a specific problem, which can be extended and applied in many other contexts.

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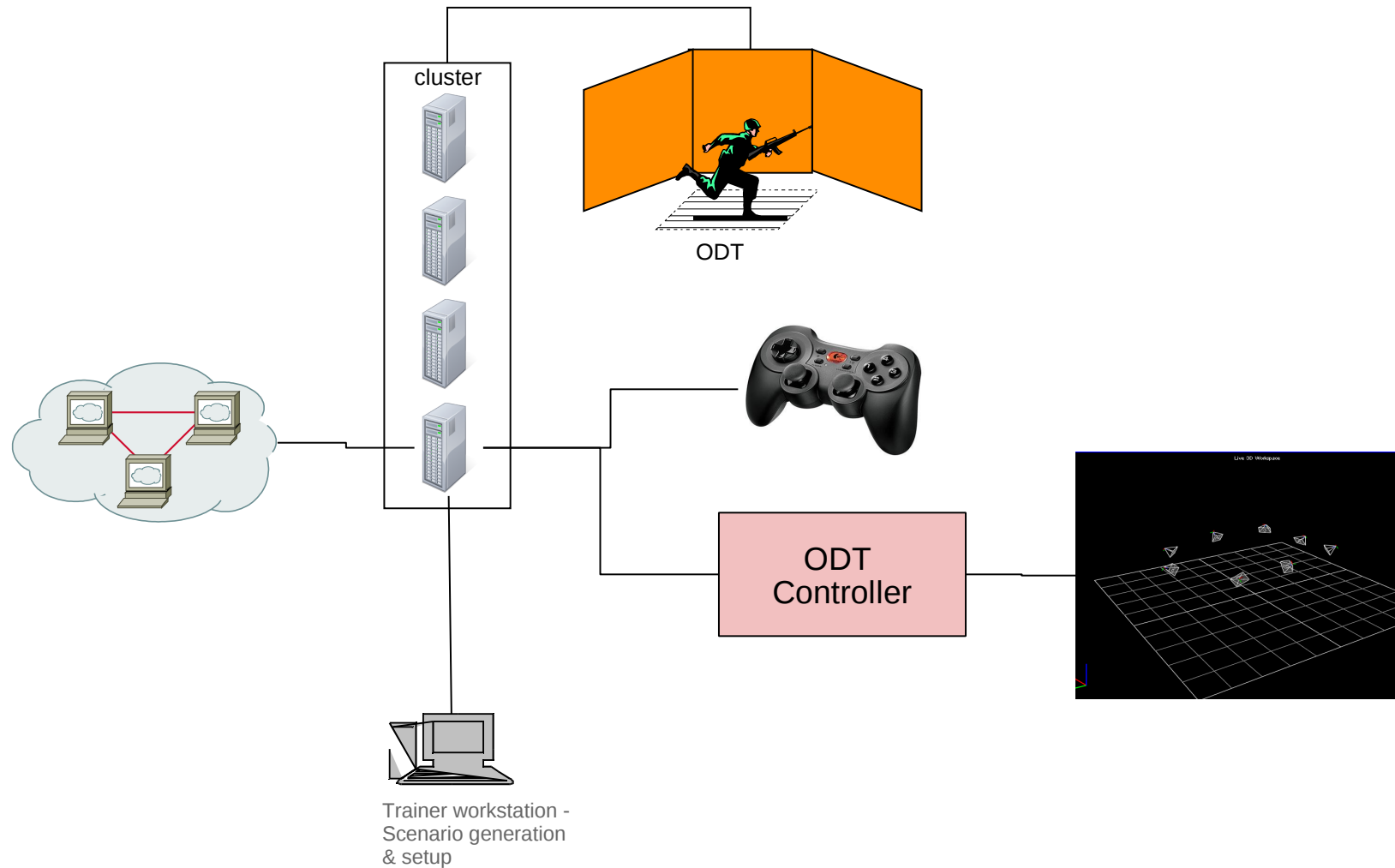
# Summary

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A practical solution to a specific problem, which **can be extended** and applied in many other contexts.



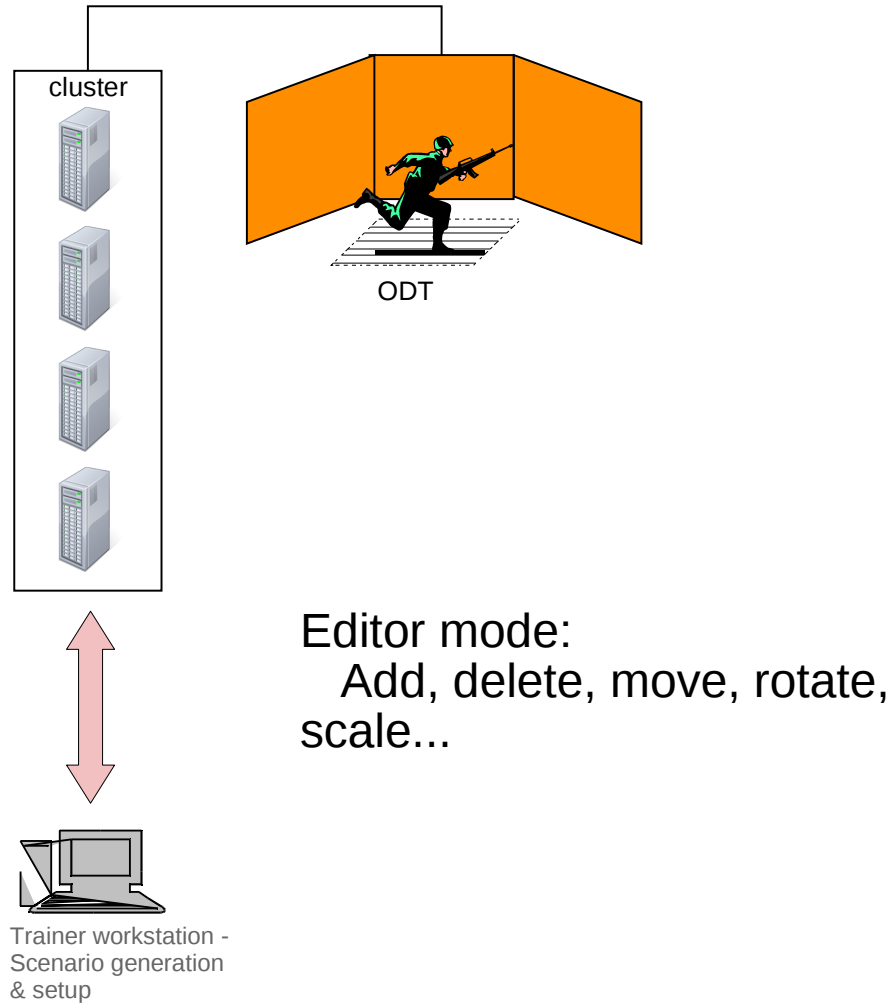
# Dismounted Soldier Immersive Scenario Simulation (DISOLISS)





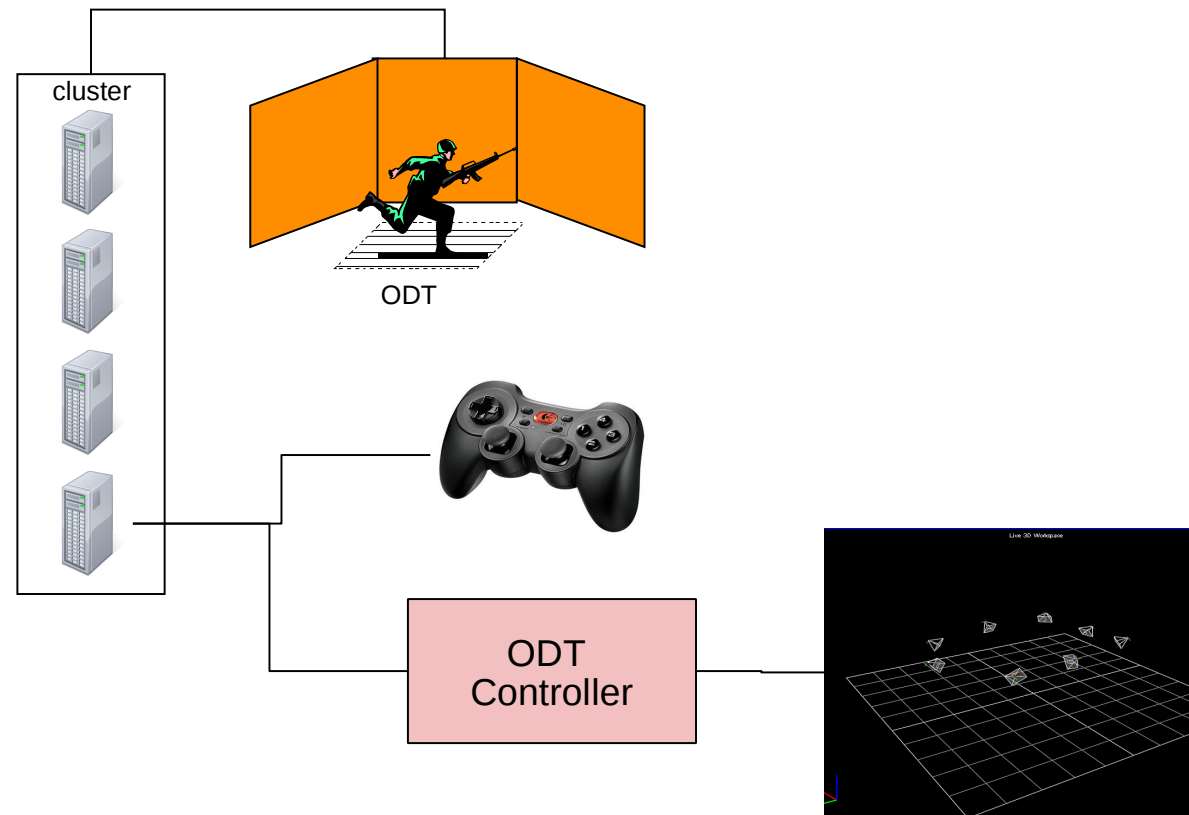
# Dismounted Soldier Immersive Scenario Simulation (DISOLISS)

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# Dismounted Soldier Immersive Scenario Simulation (DISOLISS)

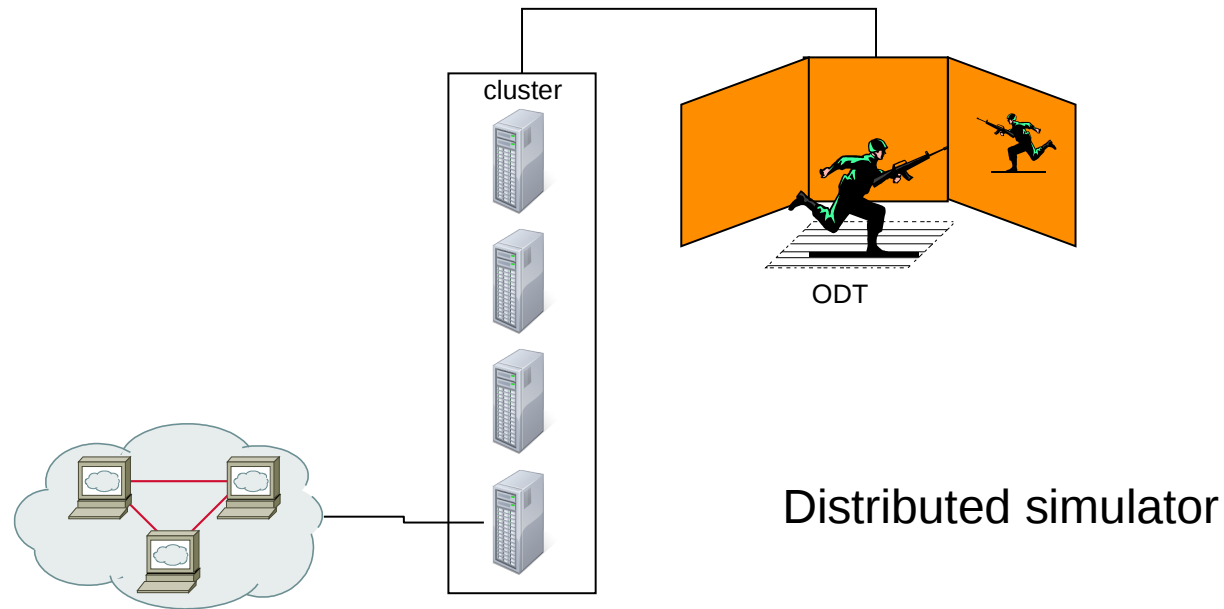
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VRJuggler ODT driver:  
ODT & Vicon input

# Dismounted Soldier Immersive Scenario Simulation (DISOLISS)

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# Distributed Interactive Simulation

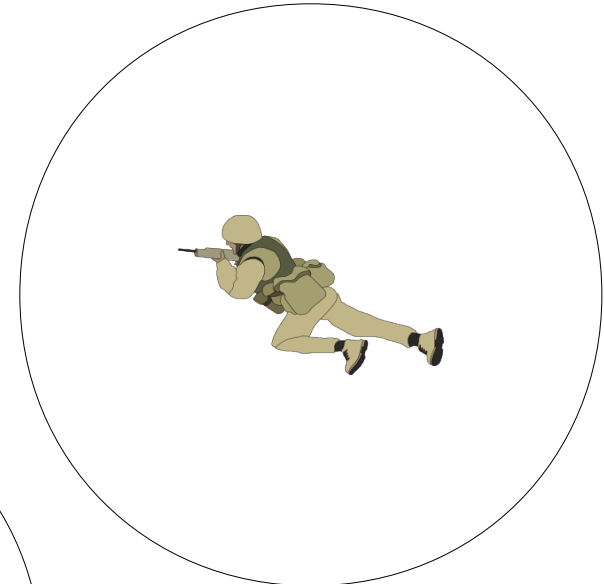
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Aberdeen

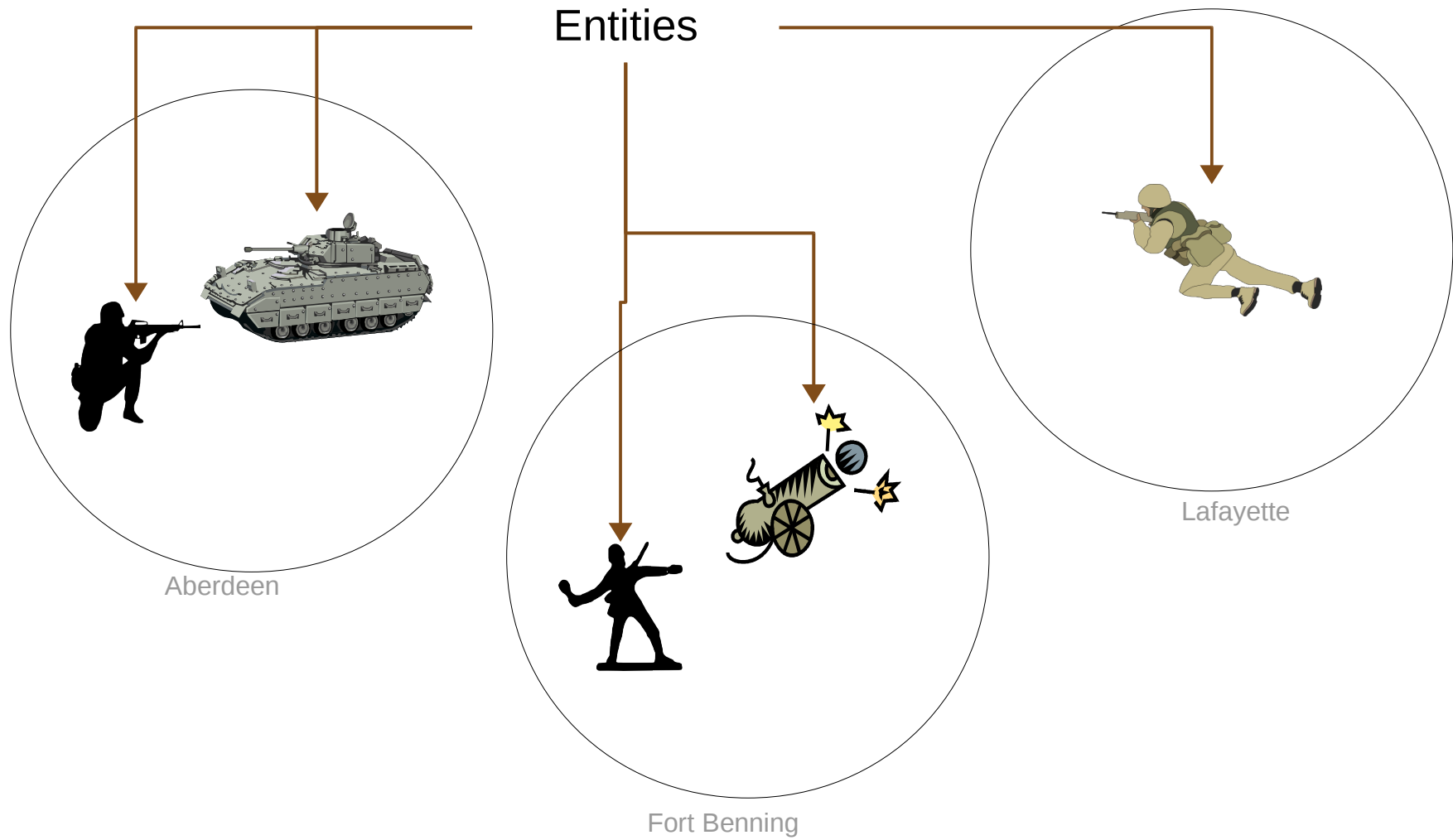


Fort Benning

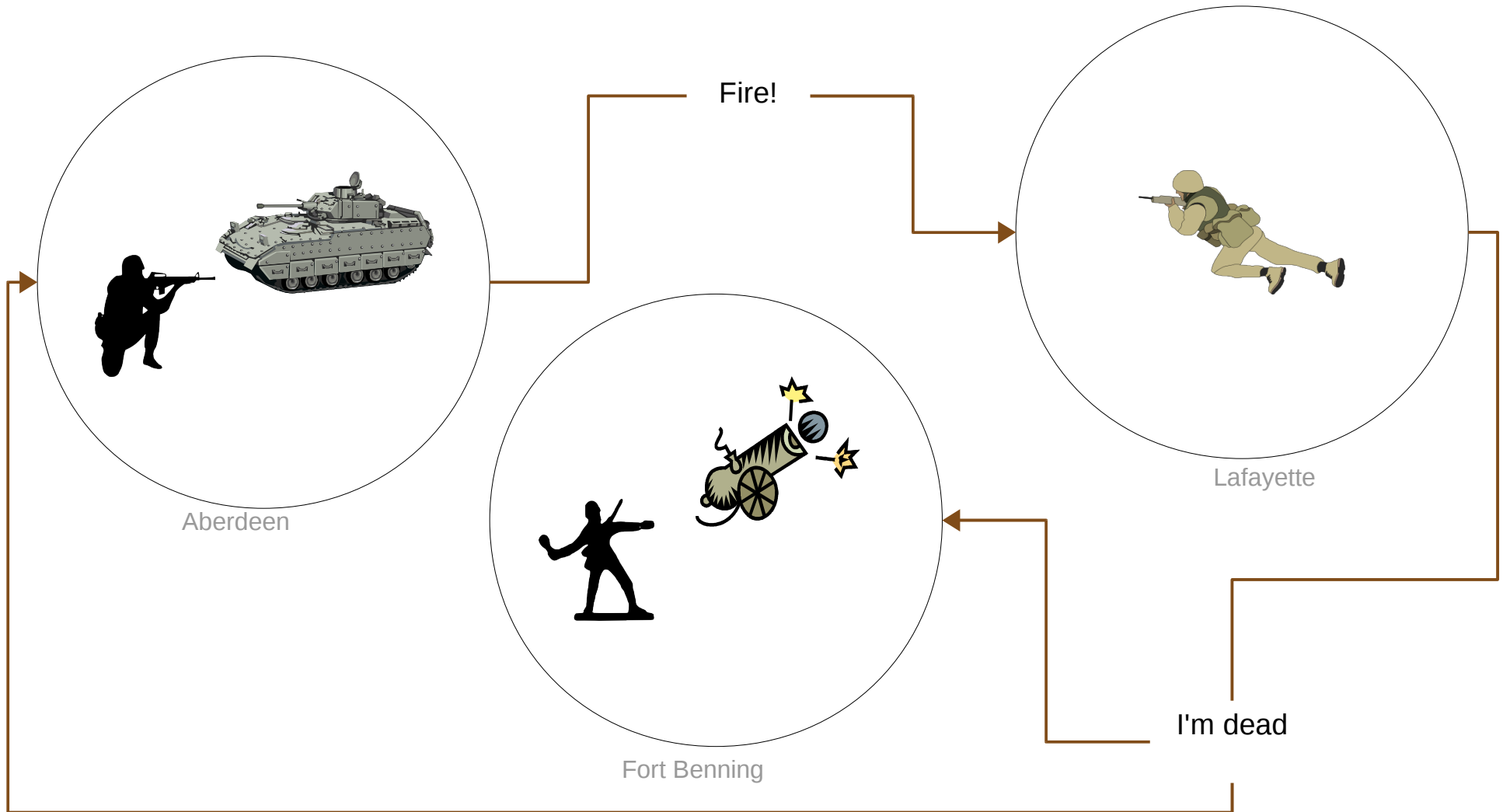


Lafayette

# Distributed Interactive Simulation



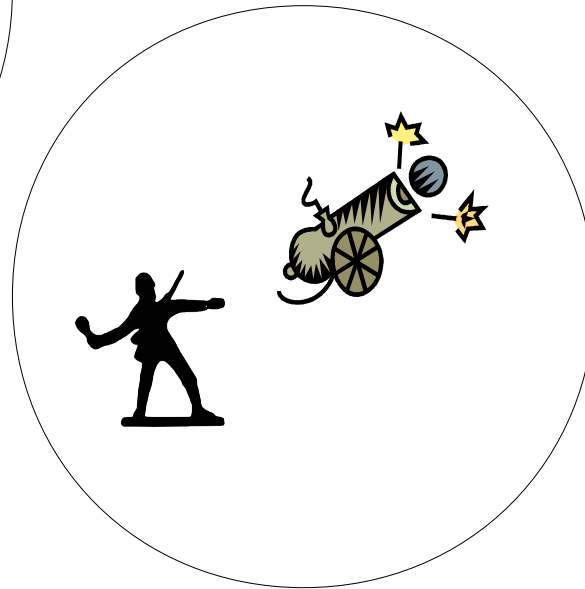
# Distributed Interactive Simulation



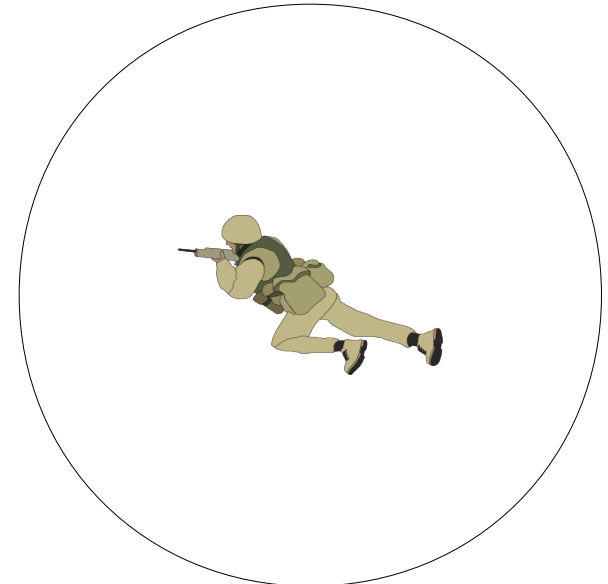
# Distributed Interactive Simulation



Aberdeen



Fort Benning



Lafayette

Fire!  
Moving;  
velocity  $V$   
I'm dead

Protocol  
Data  
Unit

# DIS protocol families and PDUs

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1. Entity information/interaction
2. Warfare
3. Logistics
4. Simulation management
5. Distributed emission regeneration
6. Radio communications
7. Entity management
8. Minefield
9. Synthetic environment
10. Simulation management with reliability
11. Live entity
12. Non-real time

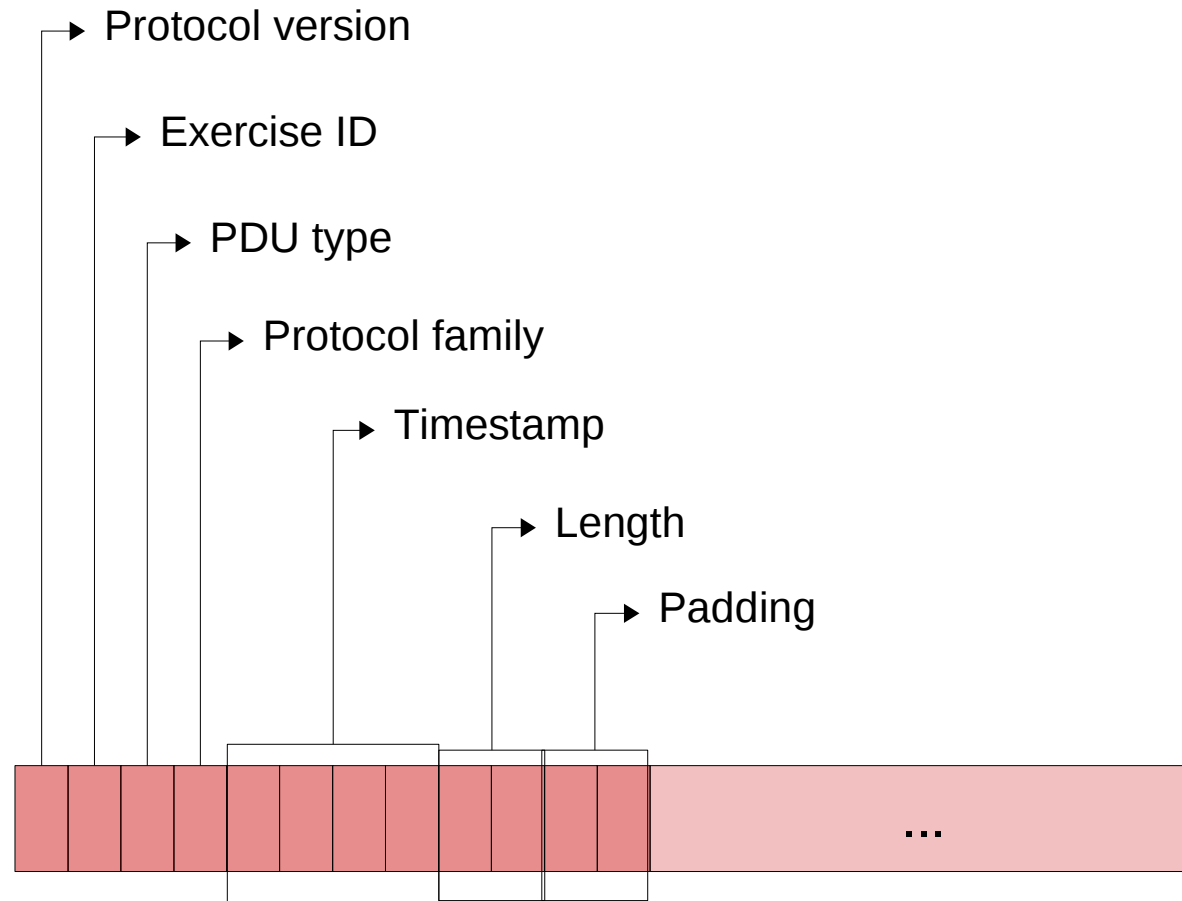


# DIS protocol families and PDUs

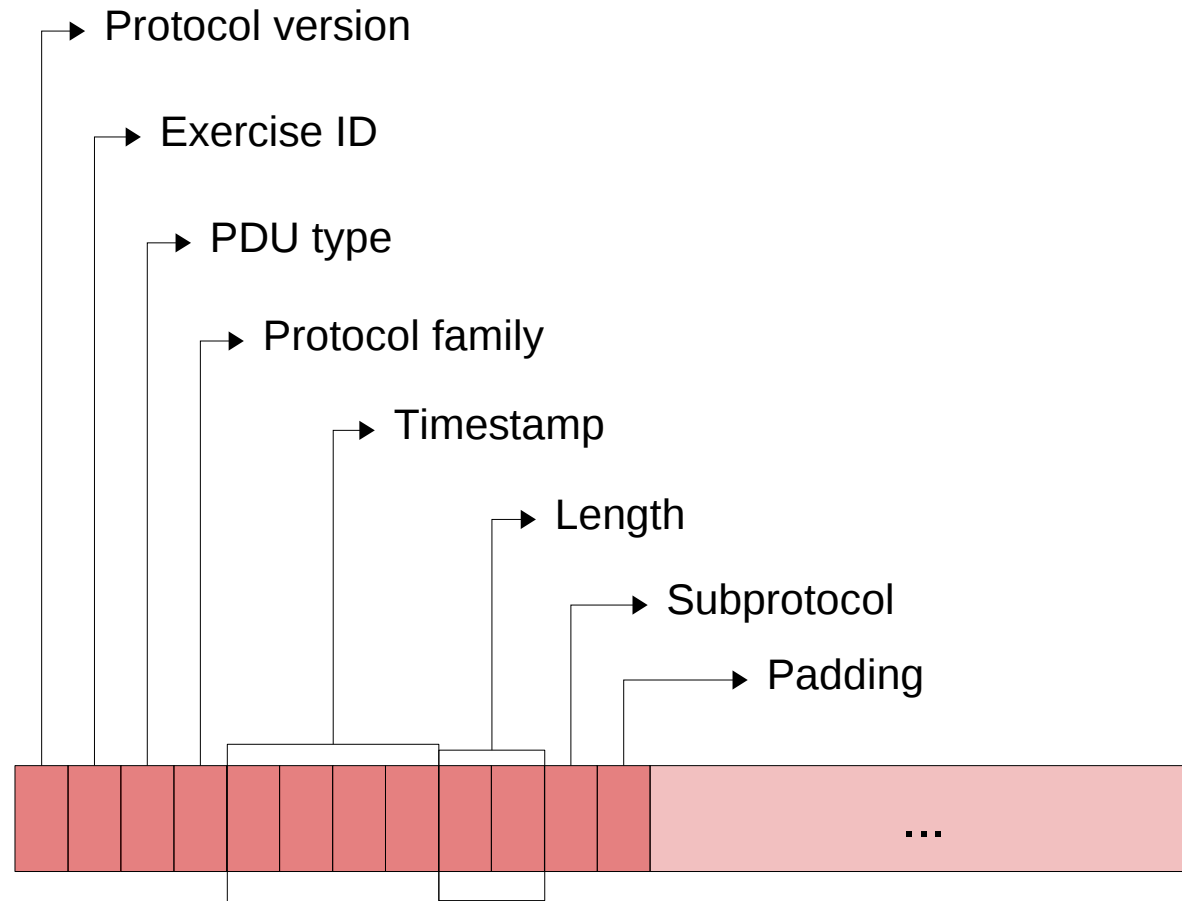
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- Entity information/interaction
  - (a) Entity State PDU
  - (b) Collision PDU
  - (c) Collision-Elastic PDU
  - (d) Entity State Update PDU
- Warfare
  - (a) Fire PDU
  - (b) Detonation PDU
- Synthetic environment
  - (a) Environmental Process PDU
  - (b) Gridded Data PDU
  - (c) Point Object State PDU
  - (d) Linear Object State PDU
  - (e) Areal Object State PDU
- Live Entity
  - (a) Time Space Position Information PDU
  - (b) Appearance PDU
  - (c) Articulated Parts PDU
  - (d) LE Fire PDU
  - (e) LE Detonation PDU

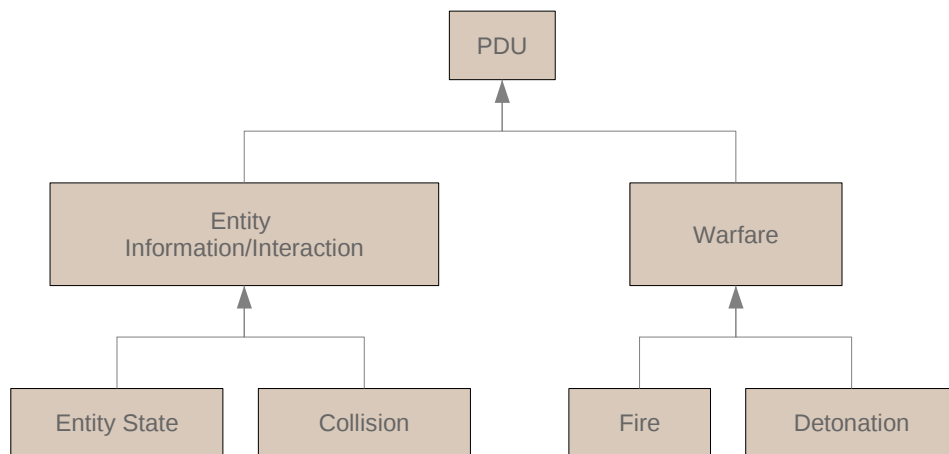
# DIS PDU



# DIS LE PDU



# Open-DIS



McGregor, D., Brutzman, D., Grant J. (2008)

## PDU

```
unsigned char _protocolVersion;
unsigned char _exerciseID;
unsigned char _pduType;
unsigned char _protocolFamily;
unsigned int _timestamp;
unsigned short _length;

Pdu();
virtual ~Pdu();

virtual void marshal(DataStream& dataStream);
virtual void unmarshal(DataStream& dataStream);

unsigned char getProtocolVersion() const;
void setProtocolVersion(unsigned char pX);

unsigned char getExerciseID() const;
void setExerciseID(unsigned char pX);

unsigned char getPduType() const;
void setPduType(unsigned char pX);

unsigned char getProtocolFamily() const;
void setProtocolFamily(unsigned char pX);

unsigned int getTimestamp() const;
void setTimestamp(unsigned int pX);

unsigned short getLength() const;
void setLength(unsigned short pX);

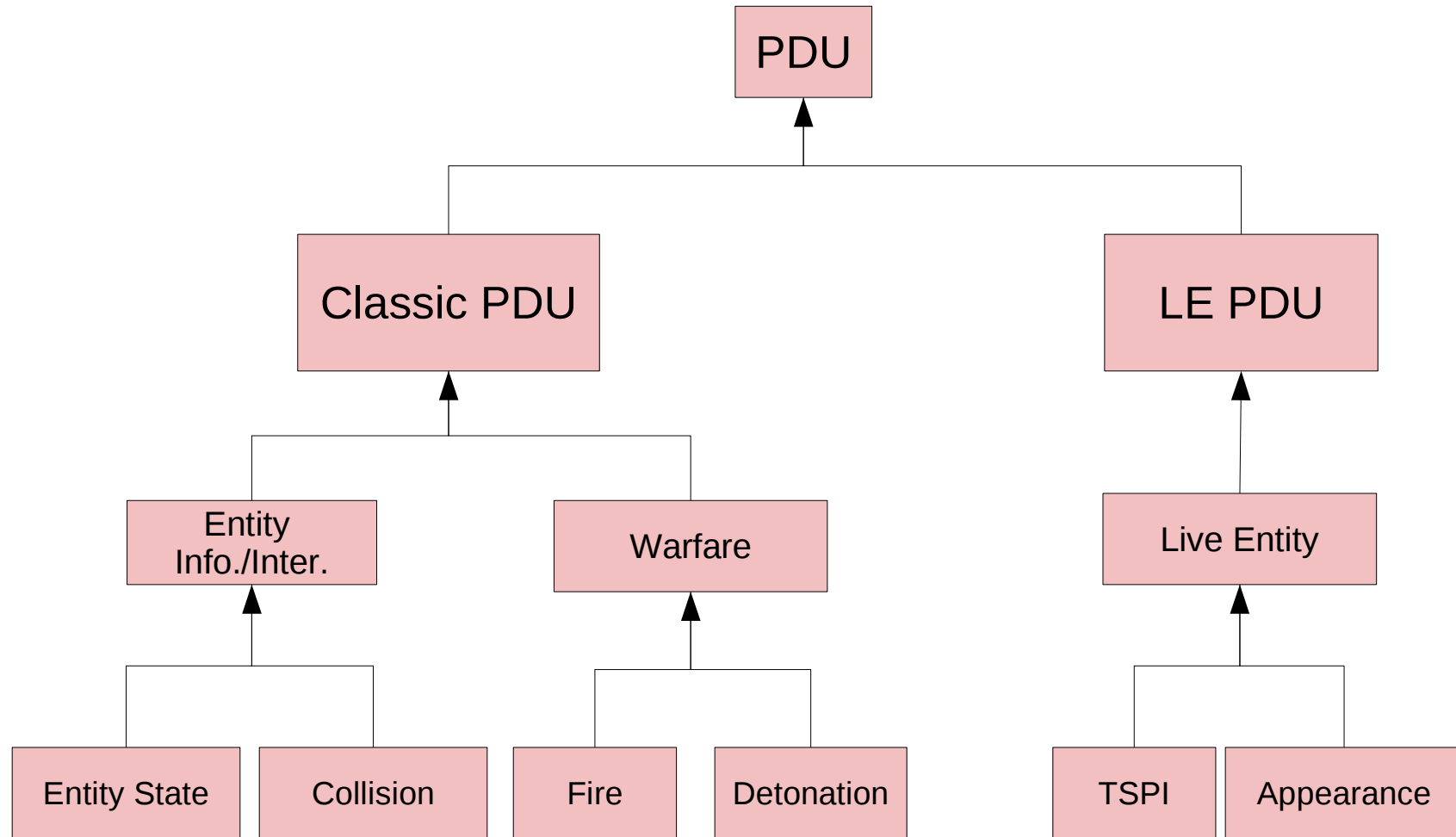
bool operator ==(const Pdu& rhs) const;
```

# XMLPG

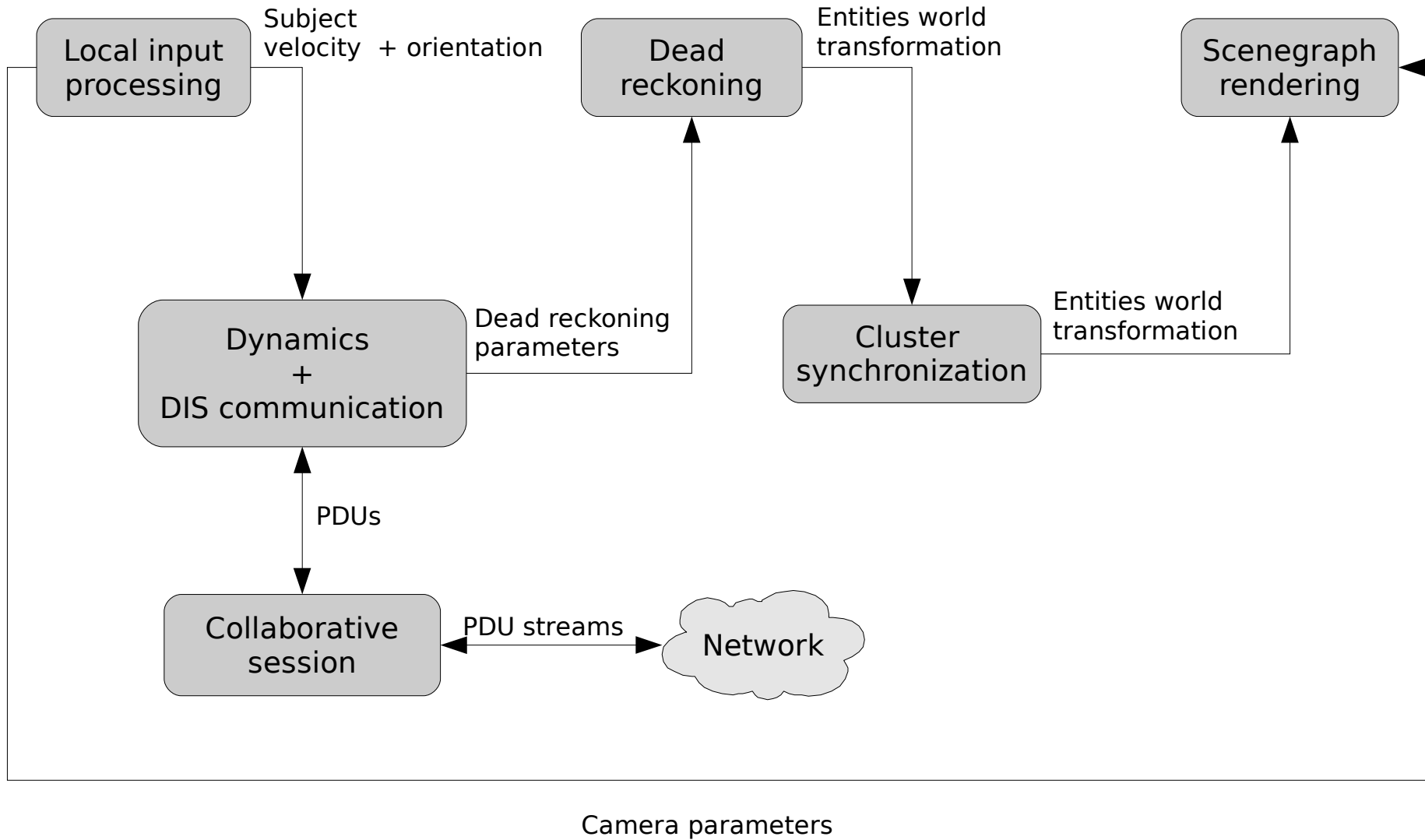
```
<class name="Pdu" inheritsFrom="root" comment="The superclass for all PDUs.">
  <attribute name="protocolVersion" comment="The version of the protocol. 5=DIS-1995, 6=DIS-1998.">
    <primitive type="unsigned byte" defaultValue="6"/>
  </attribute>
  <attribute name="exerciseID" comment="Exercise ID">
    <primitive type="unsigned byte" defaultValue="0"/>
  </attribute>
  ...
</class>

<class name="EntityInformationFamilyPdu" inheritsFrom="Pdu" comment="Section 5.3.3. Common
superclass for EntityState, Collision, collision-elastic, and entity state update PDUs.">
  <initialValue name="protocolFamily" value="1"/>
</class>
```

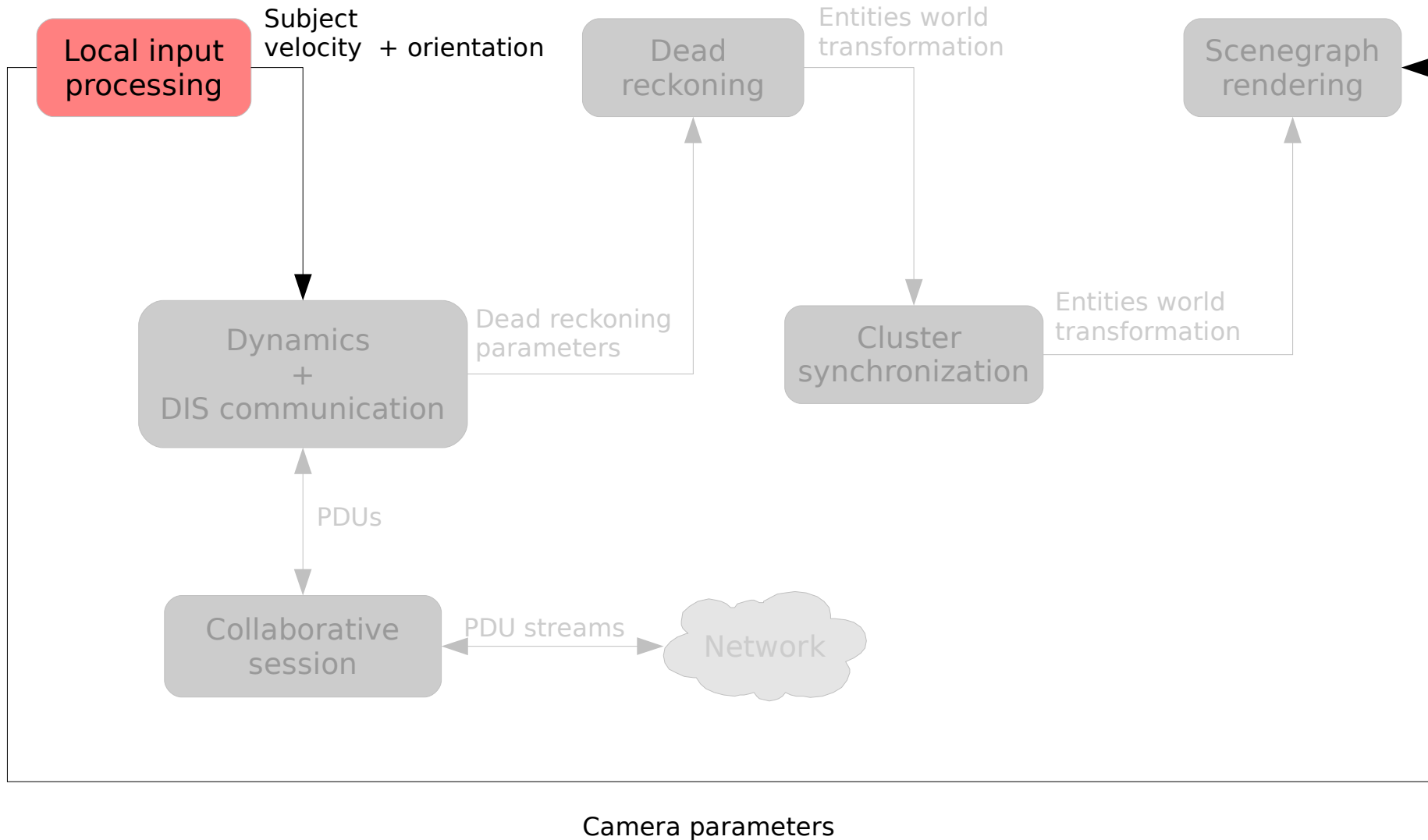
# Modified Open-DIS



# DISOLISS architecture

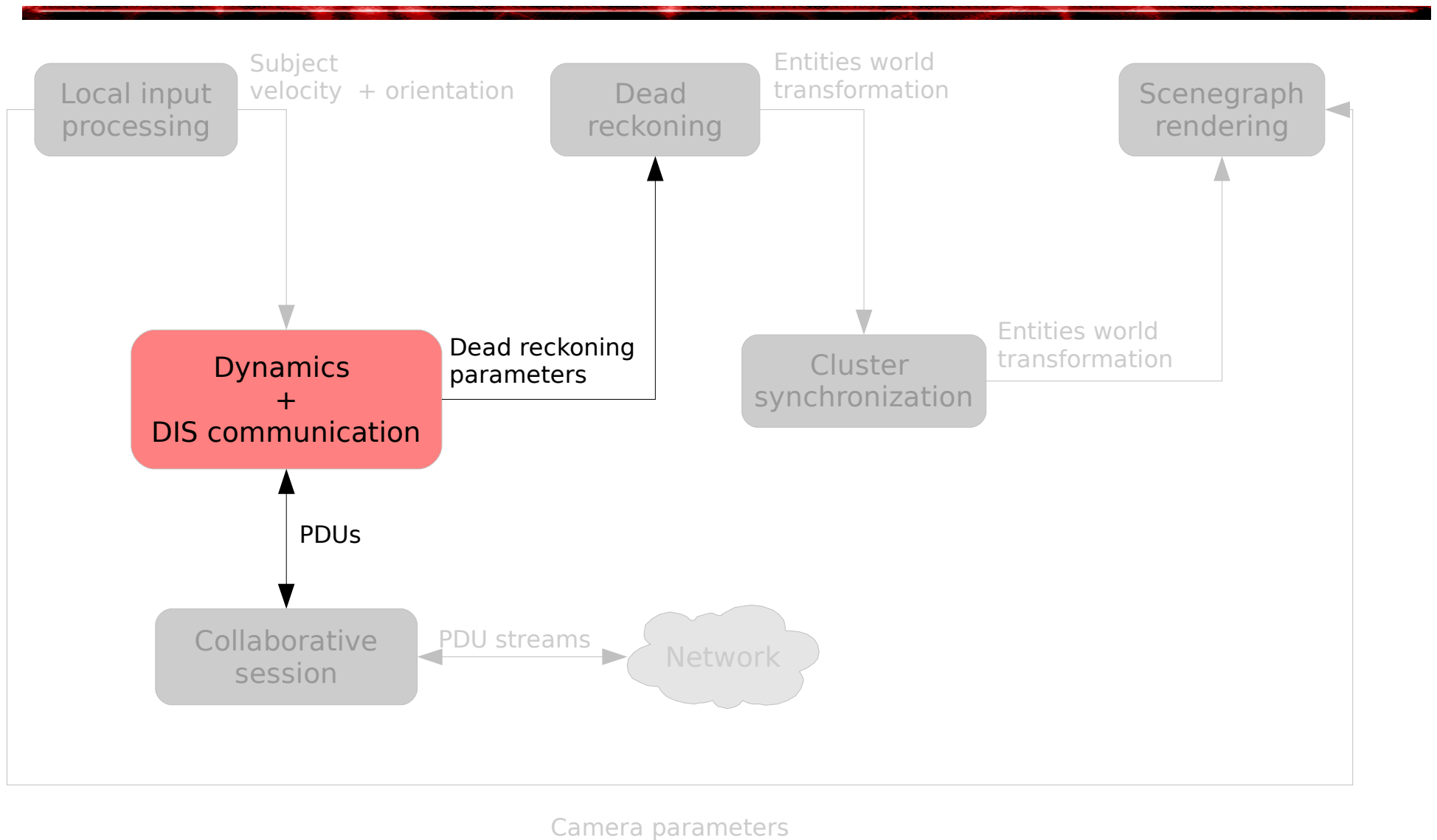


# DISOLISS architecture

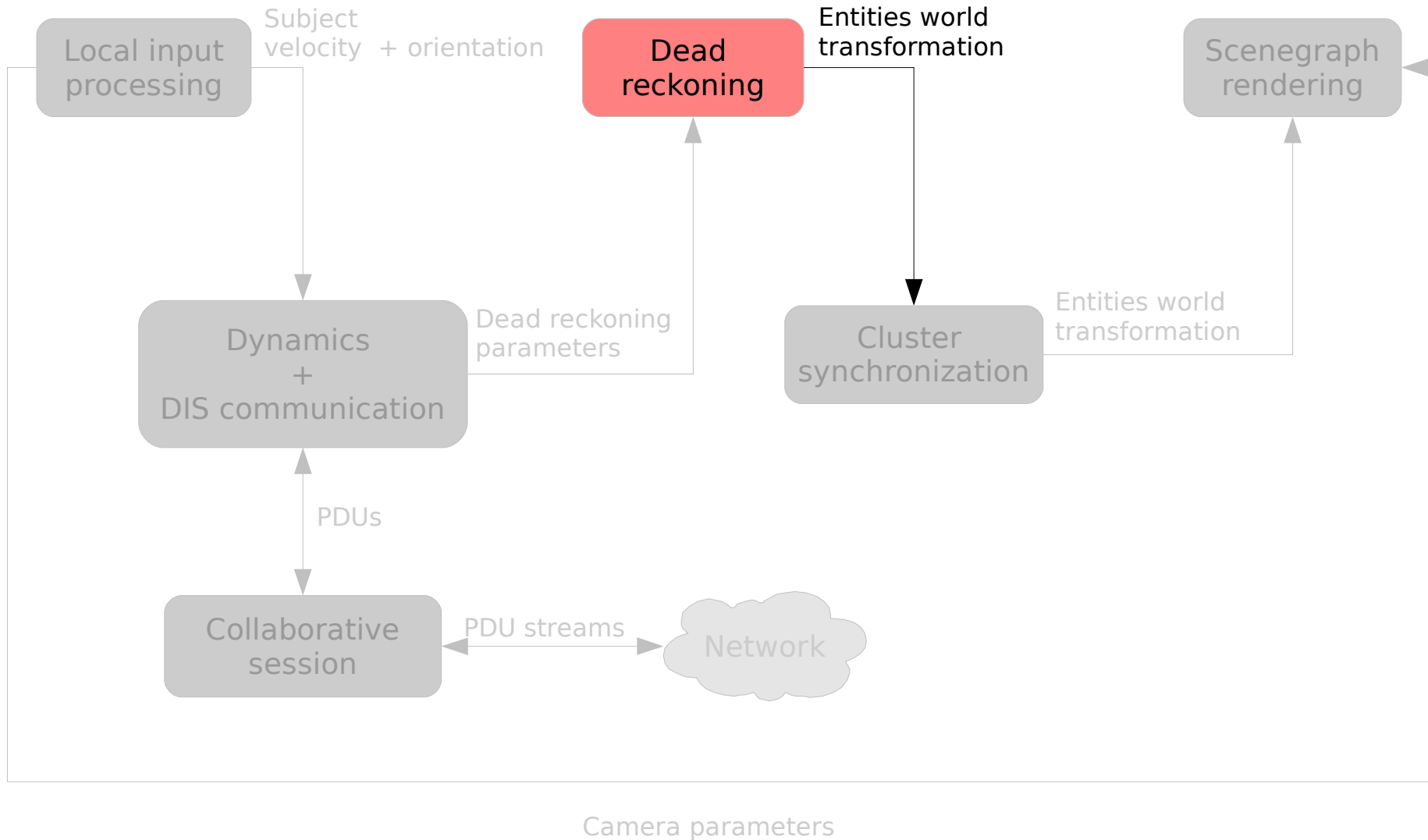




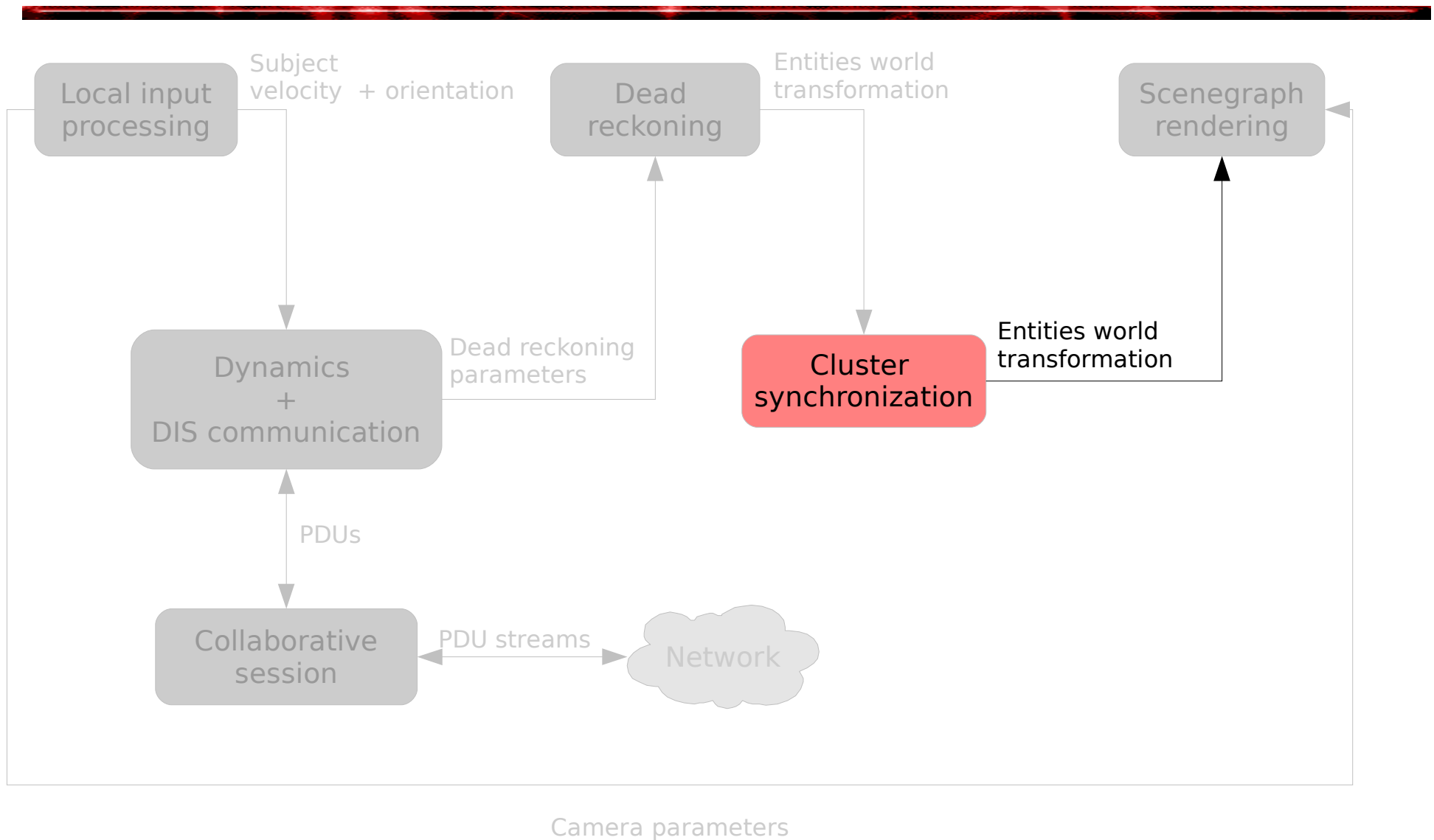
# DISOLISS architecture



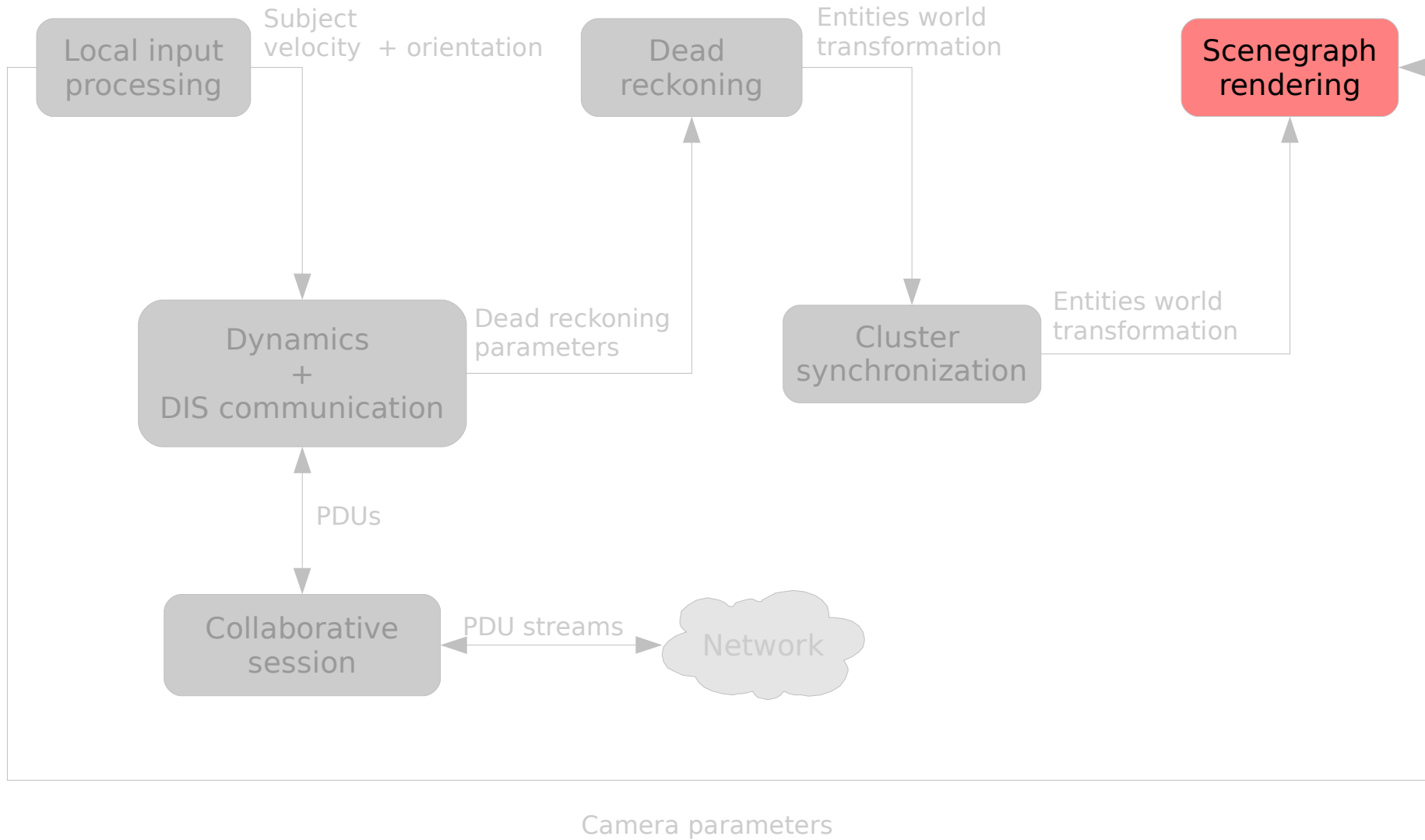
# DISOLISS architecture



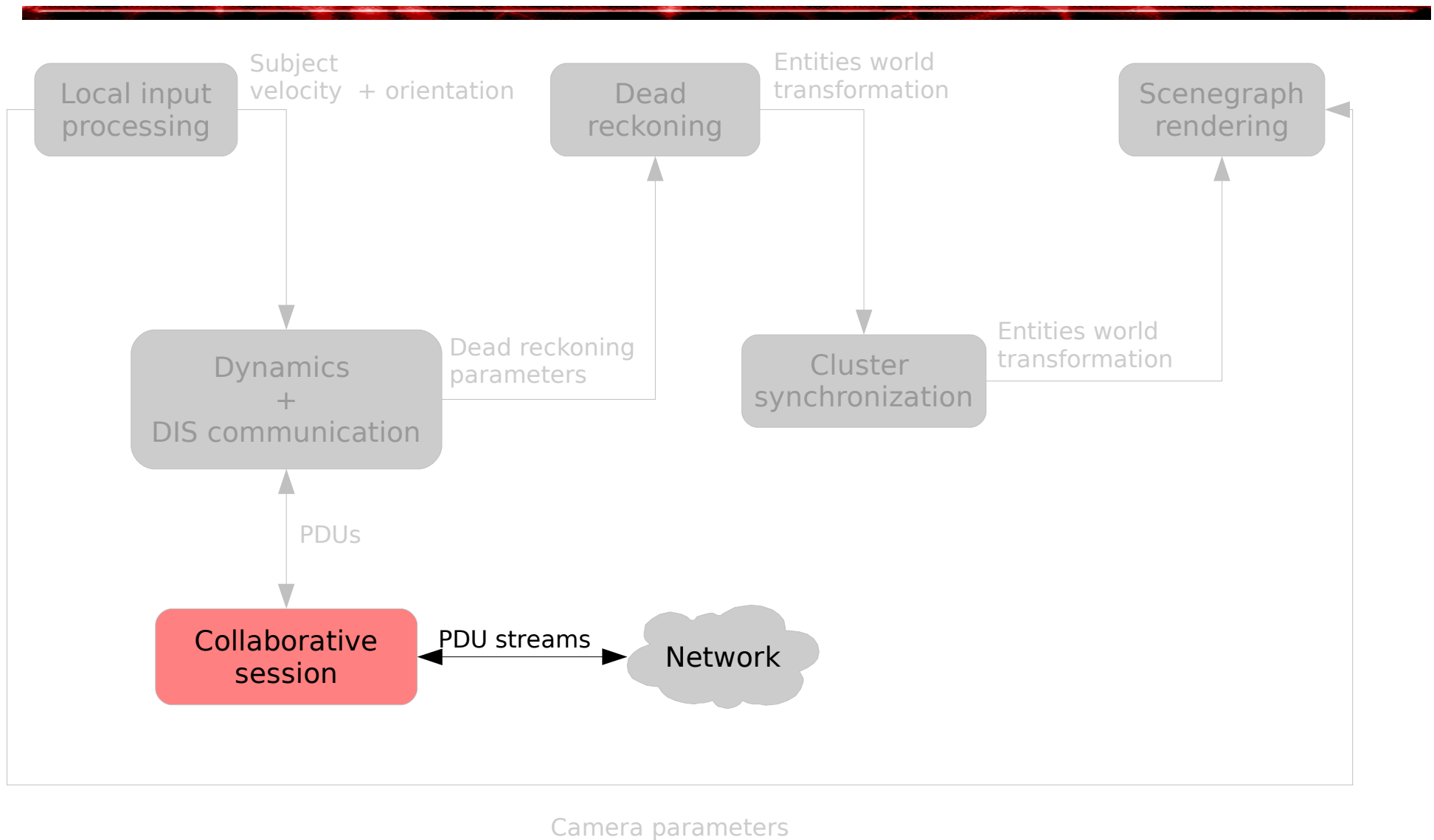
# DISOLISS architecture



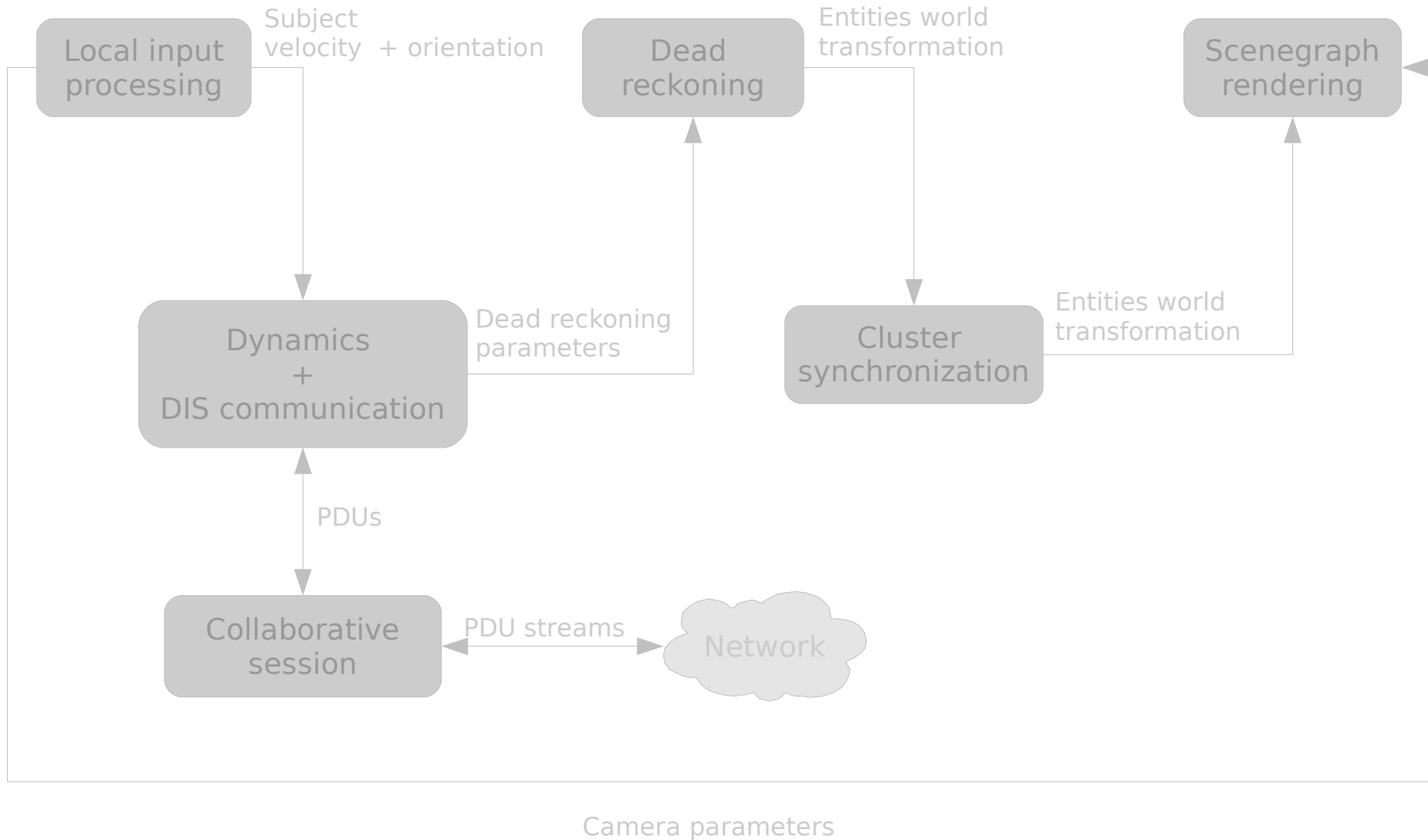
# DISOLISS architecture



# DISOLISS architecture



# DISOLISS architecture



# Summary

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- Application framework supports a wide range of scenarios
- Plug-and-play makes it easier for collaboration across different departments/institutions/fields

# Future work

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- Finish Live Entity implementation
- Event recording and data analysis
- DIS for internal communication



Thank you!



# References

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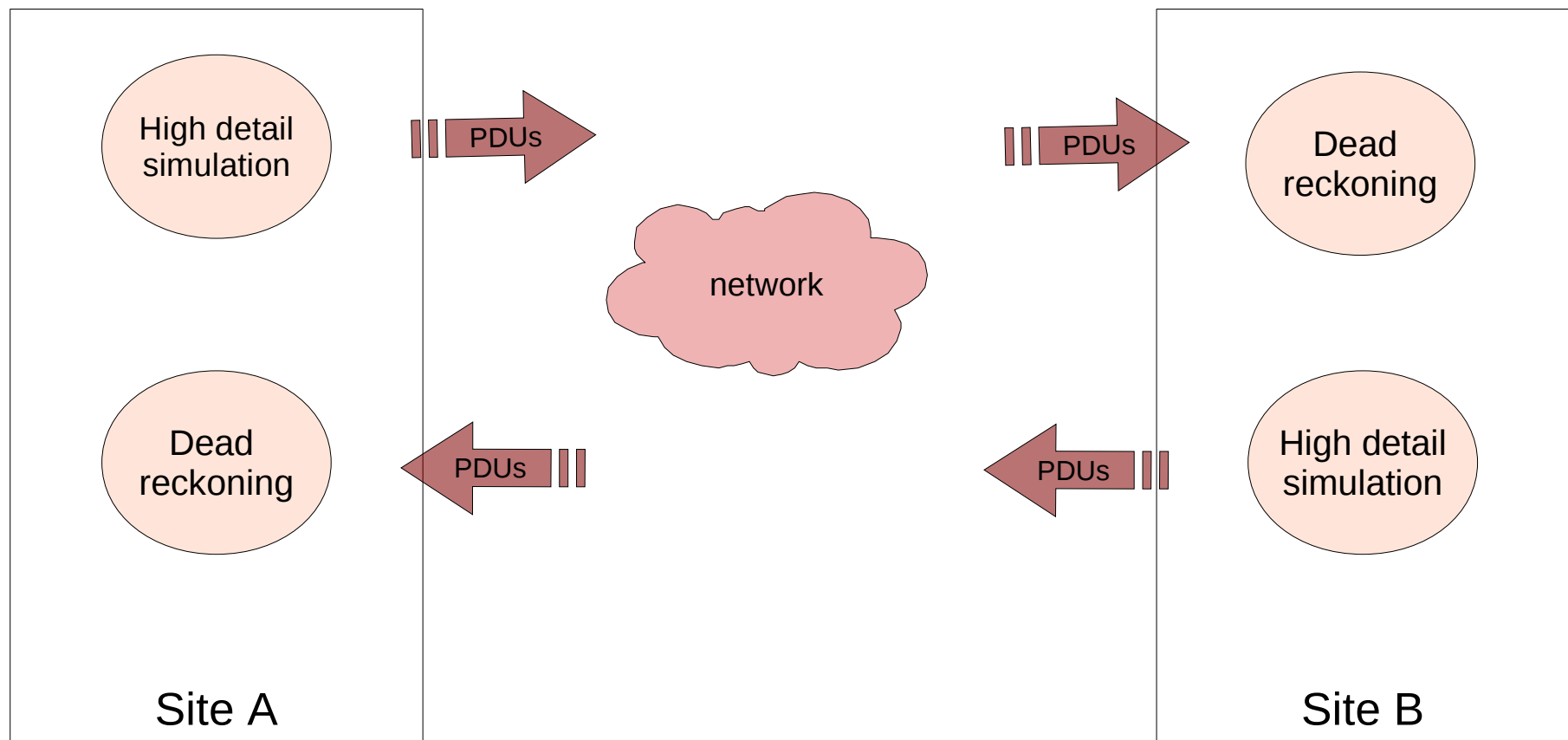
- Fielded equipment interaction or simulation
  - P. Landweer (1994). Integration of GGF with Fielded Equipment Using DIS.
  - McCarty et al (1994). A Virtual Cockpit for a Distributed Interactive Simulation.
  - Knerr and Lampton (2005) An Assessment of the Virtual-Integrated MOUT Training System (V-IMTS).
- Non-military
  - Fitzsimmons and Fletcher (1995). Beyond DoD: Non-Defense Training and Education Applications of DIS.

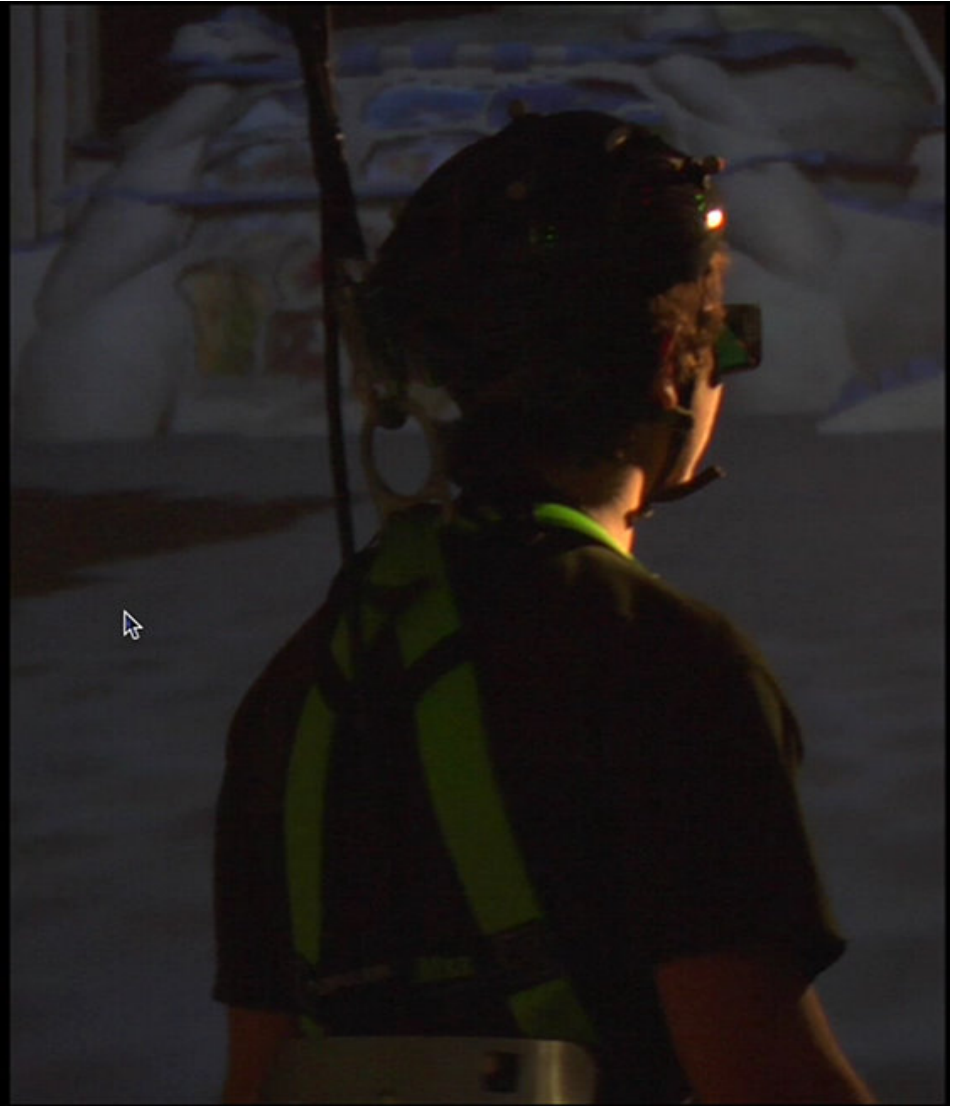
# References

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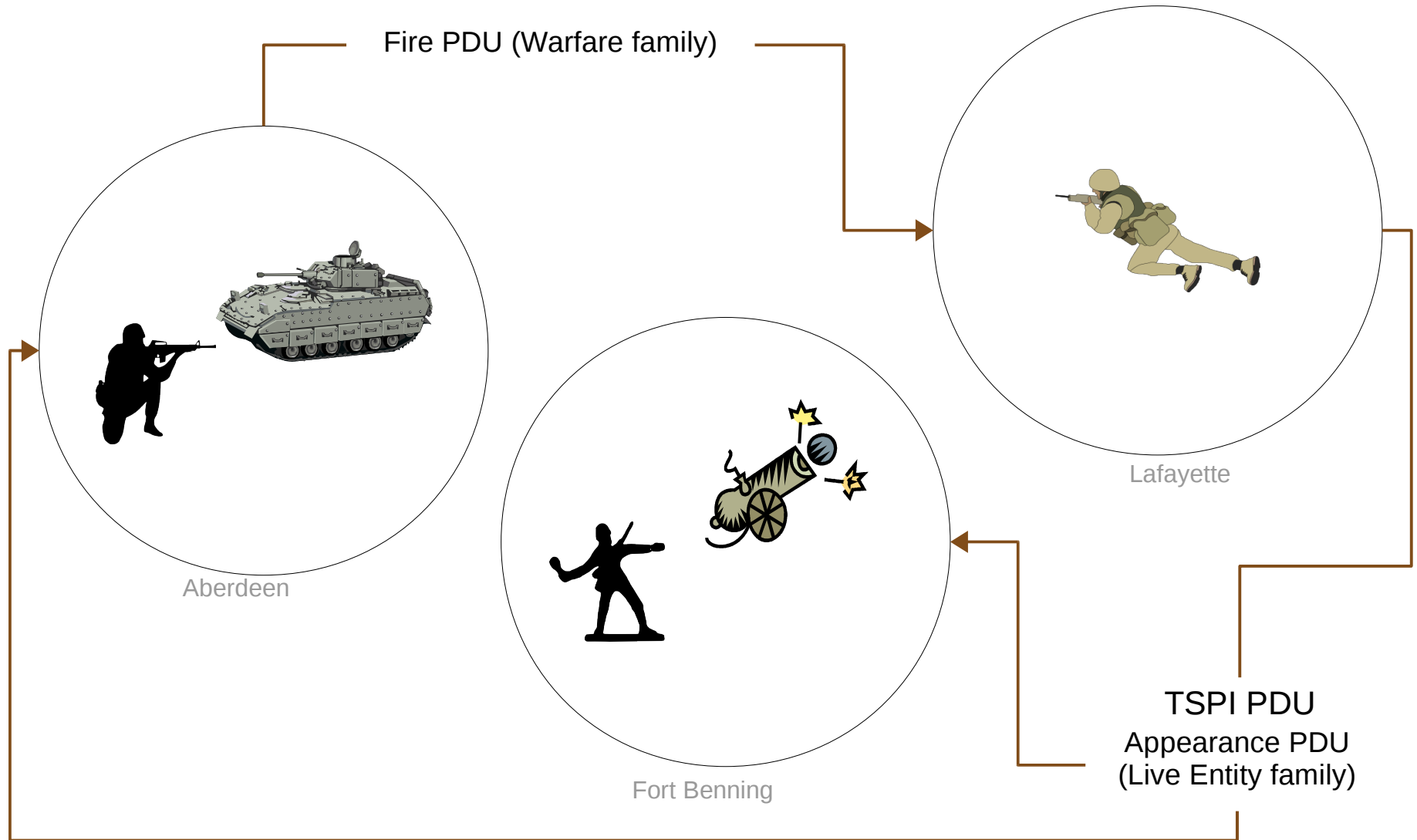
- DIS vs (HLA or TENA)
  - Protocol vs API
  - Definition of entities and events vs Object Model Template
  - Non-real time simulations

# DIS software architecture

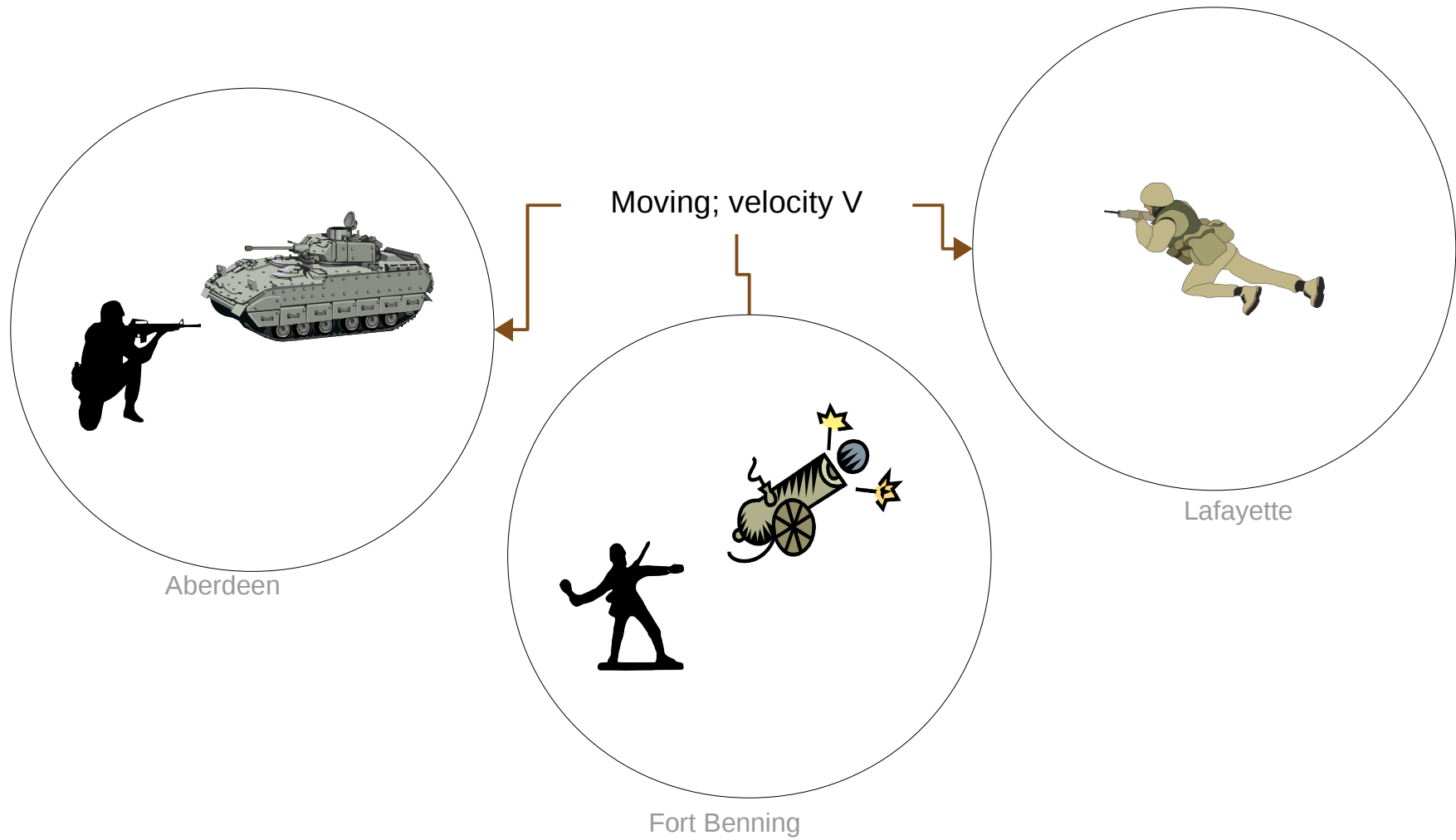




# DIS protocol families and PDUs



# Distributed Interactive Simulation



# DIS protocol families and PDUs

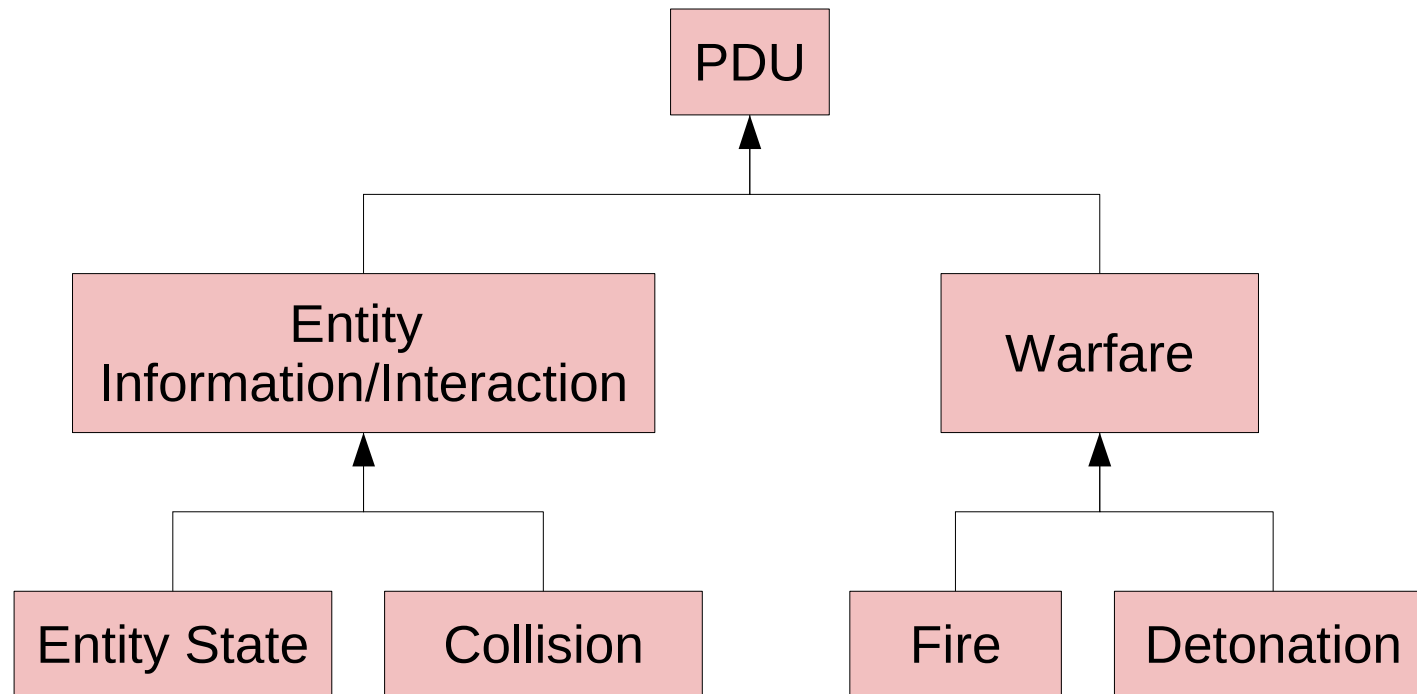
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# Open-DIS

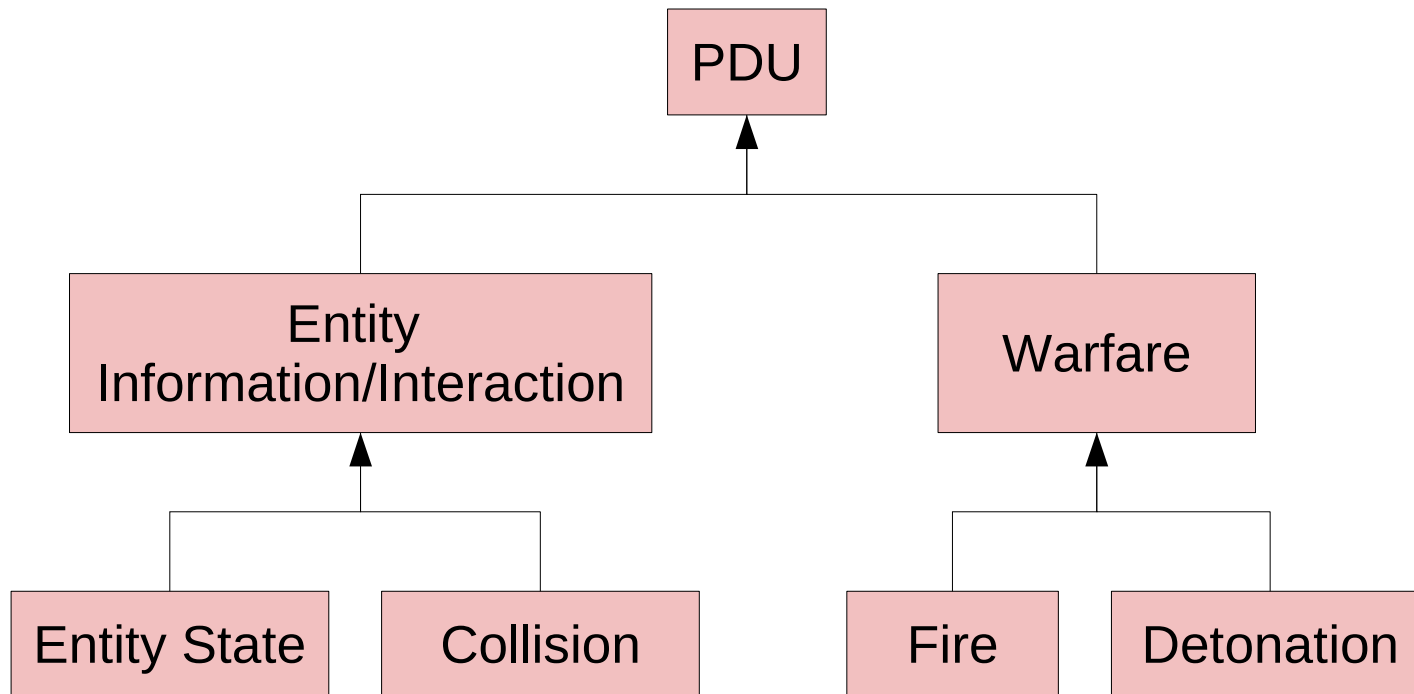
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McGregor, D., Brutzman, D., Grant J. (2008)

# Open-DIS

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McGregor, D., Brutzman, D., Grant J. (2008)