

DATA MODEL DEVELOPMENT FOR FIRE RELATED EXTREME EVENTS: AN ACTIVITY THEORY APPROACH

Rui Chen

Department of Information Systems and Operations Management, Miller College of Business, Ball State university,
Muncie, IN 47306 U.S.A. {rchen3@bsu.edu}

Raj Sharman

Management Science and Systems, School of Management, State University of New York at Buffalo,
Jacobs Management Center, Buffalo, NY 14260 U.S.A. {rsharman@buffalo.edu}

H. Raghav Rao

Management Science and Systems, School of Management, State University of New York at Buffalo,
Jacobs Management Center, Buffalo, NY 14260 U.S.A. and
Department of GSM, Sogang University, Seoul, SOUTH KOREA {mgmtrao@buffalo.edu}

Shambhu J. Upadhyaya

Computer Science and Engineering, School of Engineering and Applied Sciences, State University of New York at Buffalo,
201 Bell Hall, Buffalo, NY 14260 U.S.A. {shambhu@buffalo.edu}

Appendix A

Data Model Specification Spreadsheet

Appendix A.1 A Snippet of Data Types		
Type/Sub-Property	Type	Definition
IncidentSpecificsType	extends u:ActivityType	A structure that describes the specific characteristics of the incident
IncidentCategory	nfirs:FireIncidentCodeSimpleType	A code identifying the fire incident type such as "structure fire"
AlarmDate	u:DateType	A code identifying the date when fire is first reported
AlarmTime	niem-xsd:time	A code identifying the time when fire is first reported
AlarmMethod	AlarmMethodCodeSimpleType	A code identifying how the alarm is received from the public. E.g., telephone, municipal alarm system, private alarm system.

Table A.1 A Snippet of Data Types (Continued)		
Type/Sub-Property	Type	Definition
SituationFound	SituationFoundCodeSimpleType	A code identifying the incident situation found upon arrival
AlertLevel	u:ImageType	A code identifying the safety alert level raised
Reporter	u:PersonType	A reference to the incident reporter
UnderControlDate	u:DateType	A code identifying the date when fire is under control
UnderControlTime	niem-xsd:time	A code identifying the time when fire is under control
OverhaulDate	u:DateType	A code identifying the date when fire overhaul is conducted
OverhaulTime	niem-xsd:time	A code identifying the time when fire overhaul is conducted
IncidentLocationType	extends em:LocationType	A structure that describes details about the incident location
ParameterSafety	u:ImageType	A code identifying the level of parameter security
District	u:TextType	A description of the response district
PopulationDensity	PopulationDensityMeasureType	A description of the neighboring area population density
SurroundingRiskAssessment	u:TextType	A description of the risks and vulnerabilities that are present at the local area
Terrain	u:TextType	A description of the terrain of the incident spot
PopulationDensityMeasureType	extends u:MeasureType	A structure that describes details about the population density
@populationDensityUnitCode	PopulationDensityUnitCodeSimpleType	A code identifying the units associated with the population density reading
WeatherType	extends u:SuperType	A structure that describes details about the weather condition
Sky	u:TextType	A description of sky condition
Temperature	TemperatureMeasureType	A description of temperature
Barometer	PressureMeasureType	A description of barometer
WindSpeed	WindSpeedMeasureType	A description of wind speed
WindDirection	WindDirectionCodeSimpleType	A description of wind direction
DewPoint	TemperatureMeasureType	A description of dew point of the day
Precipitation	PrecipitationMeasureType	A description of precipitation
Humidity	u:PercentageType	A description of humidity
InterventionIndicator	niem-xsd:boolean	Indicator of intervention occurrence
TemperatureMeasureType	extends u:MeasureType	A structure that describes details about the temperature measurement
@temperatureUnitCode	TemperatureUnitCodeSimpleType	A code identifying the units associated with the temperature reading
TemperatureDescription	u:TextType	A description or narrative of the temperature

Table A.2 A Snippet of Code Lists	
CodeSimpleType	Code List
WindDirectionCodeSimpleType	base xsd:string
N	North
S	South
W	West
E	East
NW	Northwestern
NE	Northeastern
SW	Southwestern
SE	Southeastern
TemperatureUnitCodeSimpleType	base xsd:string
C	Celsius Scale
F	Fahrenheit Scale
PressureUnitCodeSimpleType	base xsd:string
PSI	Pound per square inch
GPSC	Gram per square centimeter
MMHG	Millimeter of mercury
INHG	Inch of mercury
MB	Millibar
PA	Pascal
KPA	Kilopascal
MPA	Megapascal
T/IN2	Ton per square inch
PopulationDensityUnitCodeSimpleType	base xsd:string
URB	Urban center, densely populated
SUB	Suburban, predominantly single-family residential
RUR	Rural, scattered small communities and farms
PrecipitationUnitCodeSimpleType	base xsd:string
MM	Millimeter
IN	Inch
WaterFlowUnitCodeSimpleType	base xsd:string
GPM	Gallon per minute
LPM	Litter per minute
DamageExtentSimpleType	base xsd:string
COO	Confined to the object of origin
CPR	Confined to part of room or area of origin
CRO	Confined to room of origin
CFC	Confined to fire-rated comp of origin
CFO	Confined to floor of origin
CSO	Confined to structure of origin
EBS	Extended beyond structure of origin
NDM	No damage of this type


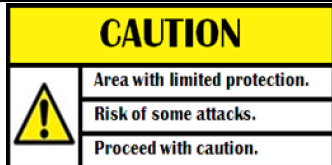

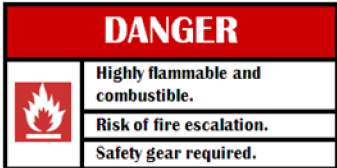
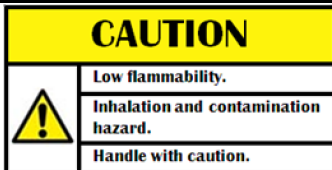

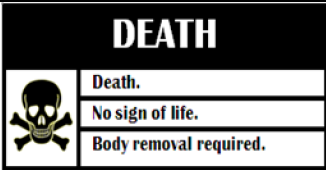



Table A.3 A Snippet of Symbol Collection		
Emergency Symbol		Definition
ParameterSafetySimpleType	base u:ImageType	A structure that describes the scene parameter security level
	ParameterSafetyLow	Low level of parameter safety
	ParameterSafetyMid	Mid level of parameter safety
	ParameterSafetyHigh	High level of parameter safety
FireLoadCodeSimpleType	base u:ImageType	A structure that describes the fire load of onsite materials
	FireLoadHigh	High level of fire load
	FireLoadMid	Mid level of fire load
	FireLoadLow	Low level of fire load

Table A.3 A Snippet of Symbol Collection (Continued)		
Emergency Symbol		Definition
InjurySeveritySimpleType	base u:ImageType	A structure that describes the injury level of victims
	InjurySeverityDead	Death
	InjurySeverityHigh	High level of injury severity
	InjurySeverityMid	Mid level of injury severity
	InjurySeverityLow	Low level of injury severity

Appendix B

Snippets of Data Model XML Schema

Table B1. Snippet of the Data Type Schema

```

<!--Define Types-->
<xsd:complexType name='IncidentSpecificsType'>
  <xsd:complexContent>
    <xsd:extension base='u:ActivityType'>
      <xsd:sequence>
        <xsd:attribute ref='IncidentCategory' use='optional' />
        <xsd:element ref='AlarmDate' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='AlarmTime' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='AlarmMethod' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='SituationFound' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='AlertLevel' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='Reporter' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='UnderControlDate' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='UnderControlTime' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='OverhaulDate' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='OverhaulTime' minOccurs='0' maxOccurs='unbounded' />
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name='IncidentLocationType'>
  <xsd:complexContent>
    <xsd:extension base='em:LocationType'>
      <xsd:sequence>
        <xsd:element ref='ParameterSafety' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='District' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='PopulationDensity' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='SurroundingRiskAssessment' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='Terrain' minOccurs='0' maxOccurs='unbounded' />
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name='WeatherType'>
  <xsd:complexContent>
    <xsd:extension base='u:SuperType'>
      <xsd:sequence>
        <xsd:element ref='DewPoint' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='WindSpeed' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='Humidity' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='Barometer' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='Temperature' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='Precipitation' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='Sky' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='InterventionIndicator' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='WindDirection' minOccurs='0' maxOccurs='unbounded' />
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>

```

```

<xsd:complexType name='TemperatureMeasureType'>
  <xsd:complexContent>
    <xsd:extension base='u:MeasureType'>
      <xsd:sequence>
        <xsd:element ref='TemperatureDescription' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref=' @temperatureUnitCode' minOccurs='0' maxOccurs='unbounded' />
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name='PressureMeasureType'>
  <xsd:complexContent>
    <xsd:extension base='u:MeasureType'>
      <xsd:sequence>
        <xsd:element ref=' @pressureUnitCode' minOccurs='0' maxOccurs='unbounded' />
        <xsd:element ref='AtTemperature' minOccurs='0' maxOccurs='unbounded' />
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>

```

Table B.2 Snippet of Property Schema

```

<!--Define Properties-->
<xsd:attribute name='PopulationDensityUnitCodeSimpleType' type='xsd:string' />
<xsd:element name='TemperatureDescription' type='u:TextType' />
<xsd:element name=' @temperatureUnitCode' type='TemperatureUnitCodeSimpleType' />
<xsd:attribute name='SpecificInjuryLocation' type='nfirs:AreaOfFireOriginCodeSimpleType' />
<xsd:attribute name='ProtectiveEquipmentFailure' type='nfirs:ProtectiveEquipmentProblemCodeSimpleType' />
<xsd:attribute name='ProtectiveEquipment' type='nfirs:ProtectiveEquipmentCodeSimpleType' />
<xsd:attribute name='ObjectInvolved' type='nfirs:ObjectInvolvedInInjuryCodeSimpleType' />
<xsd:attribute name='PriorPhysicalCondition' type='nfirs:PhysicalConditionPriorToInjuryCodeSimpleType' />
<xsd:element name='FirefighterReference' type='ResponsePersonnelType' />
<xsd:element name='WindSpeedDescription' type='u:TextType' />
<xsd:element name='ResponsePersonnelReference' type='ResponsePersonnelType' />
<xsd:element name='ActivityReference' type='u:ActivityType' />
<xsd:attribute name='NonHumanFactoryToInjury' type='nfirs:FactorToInjuryCodeSimpleType' />
<xsd:element name='InjuryDate' type='u:DateType' />
<xsd:element name='CasualtyNumber' type='u:TextType' />
<xsd:attribute name='Disposition' type='nfirs:TakenToCodeSimpleType' />
<xsd:attribute name='HumanFactorToInjury' type='nfirs:HumanFactorToInjuryCodeSimpleType' />
<xsd:element name='ActivityReference' type='u:ActivityType' />
<xsd:element name='InjuryTime' type='niem-xsd:time' />
<xsd:attribute name='InjuryLocation' type='nfirs:InjuryLocationCodeSimpleType' />
<xsd:attribute name='ApparentSymptom' type='nfirs:PrimaryApparentSymptomCodeSimpleType' />
<xsd:element name='AlarmMethod' type='AlarmMethodCodeSimpleType' />

```