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# Technologies in Emergency & Disaster Management

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# About NICTA



Confidentia

- Federally funded ICT research institute
  - Research, Linkages, Education, Commercialisation
- 5 Labs (SYD, CAN, MEL, BNE)
- 1 Office (ADE)
- 350 Staff and Students
- Queensland Lab
  - Research Strategic Challenge
    - Safeguarding Australia
  - Disaster Prediction, Response, and Recovery Project

# **DisPRR Project**



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- Disaster Prediction, Response, and Recovery
  - Improving the ICT technologies, devices, information systems, networks, systems and services in the emergency/disaster management domain
- The project will achieve this through
  - Enabling coordination and sharing of information & resources across multiple agencies
  - Better prediction and detection of early indications
  - Supporting dynamic, mobile response teams



#### **Real World**



 Sensors
 Differentiation

 Information
 Situational

 Integration
 Situational

 Becure Networks
 Sensors

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### Sensors



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- Sensors gather the raw data
  - Data Sensors (fire, waves)
    - Reliability and certainty
  - Video Surveillance systems
    - Tracking people (or behaviour) of interest
    - "Smarts" on the camera to direct attention to the operator
    - Multi-resolution Cameras
  - Response sensors
    - People finders

# Intelligent CCTV



# Information Integration

- Information Management
  - Modeling & representation
  - Multiple sources
  - Support decision making
- Information interoperability
  - Technical Standards
  - CAP, EDXL
- Information sharing
  - Response Teams
  - Public Warnings

# **Situational Awareness**

- "Right Information to the Right People in the Right Form at the Right Time"
  - From the First Responders to the Prime Minister (President)
- Decision Making
- Integration Model
  - Level 0/1 Data/Object Sources
  - Level 2 Situational Awareness
  - Level 3 Threat/Impact Assessment
- Requires high levels of semantic modeling and reasoning algorithms

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# **Incident Notifications**



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- Information notification critical to Disasters, Incidents, Crisis, and Emergencies (DICE)
- Notifications report data from sensors, alerts, changed situations, actions, observations on objects of interest, warnings, resource requests, spatial/temporal data...
  - Automatic and manual
- Key requirements
  - Semantics and behaviour
  - Routing and decision making
  - Security and trust

# **Standards**



- IEEE Standard for Common Incident Management Message Sets
- OASIS Emergency Management Technical Cmte
  - Common Alert Protocol (CAP)
    - Emergency alerts/public warnings
    - Defines vocabulary but can be inconsistent
      - response=Evacuate & severity=Minor
  - Emergency Data Exchange Language (EDXL)
    - Framework for Distributing messages
    - Resource Management

# **Human Factors**

- Human-system integration
  - Eliciting and modeling the role and needs of human responders
  - User Interfaces
  - Usability Trials
- Detecting Abnormal behaviour
- Detecting response (or lack of) patterns in first responders

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# **Trusted Systems**



- All data is "bits"
  - Images, video, audio, sensors...
  - collected, transmitted, stored, viewed...
- Trust must exist in the underlying ICT systems supporting sensor based data collection
- Often the weakest link is under attack
  - weaknesses known by opponents
  - weaknesses inherent in commodity systems
- Trusted Computing Platforms

# **Secure Networks**



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- Self-configuring, self-healing Networks
  - wired, wireless, ad-hoc, mesh, hybrid networks
- Distributed Network/System Management and Monitoring
- Use of Context information
  - Location, device type etc.
  - Formal Context Model
- Security
  - Authentication, Access Control, Confidentiality
- Trust & Policy
  - Identity Management

### **Secure Networks**





## Architecture



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# **Technical View**



- Technology Requirements
  - Platform & Device independence
  - Discoverable
  - Robust and Reliable
  - Secure & Trusted
- Web Services
  - SOAP, WS Notification...
- Goal: Interoperability
  - Across Platforms (=standards)
  - Across Agencies/Jurisdictions (=AIIMS)



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# AIIMS

- Australasian Inter-service Incident Management Systems (AIIMS)
  - Common mgt framework for control of incidents for (multiple) organisations
  - Defines roles and responsibilities across agencies and authorities
  - Provision of information thru "Information Unit"
    - Responsible for accurate and regular flow of information to internal & external parties
- Use as a basis for an AIIMS "Technical" Framework

# AIIMS





# Where is the Info?



- Emergency Provider Access Directory
  - Registry of emergency agencies/groups and instant notification of DICE events
  - Register your interest profile
    - event types and spatial area
  - Sends CAP messages
  - Web Services (SOAP) interfaces
- E-Plan
  - Information for 1st Responders
  - Collection of site information

#### **EPAD - Interest - Incident Types**



#### **EPAD - Interest - Spatial** . NATIONAL State: WA - Vinginia Load State Area County FREDERICK Load County Area FLUVANNA Locality: FRANKLIN FRANKI IN RECORDER FREDERLOKSBURG Interest L GALAX Select "lega GILES fines the area for which your agency has legal responsibility. Select "notice (Choose one) ..... area" if the inGLOUCESTER responsible (GOOCHLAND ich you would like to receive notification about but your agency is not legally GRAYSON GREENE GREENSVILLE HALIFAS HAMPTON HANOVER HARRISONBURG HENRICO HENRY HIGHLAND HOFEWELL ISLE OF WIGHT JAMES CITY KING AND QUEEN KING GEORGE KING WILLIAM LANCASTER Washington LEE LEXINGTON LOUDOUN LOUESA

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#### **EPAD - Contact Mechanisms**

Phone Type:	Select Type	
Phone Number:		
Description:		
mergency Con	tact E-Mail	
E Mail Addresses		_
Enmail Address:		_
E-Mail Recipient's Name:		
		_
Computer Ad	dress:	
Message Form	nat Message Destination	
present of the second		_

### E-Plan

Facility Na	Incident Manager's Page (Normal View) Facility: ISSPEC CHEM, INC. (DEMO)			
	Company/Owner/Operator Name		ISSPEC GROUP OF COMPANIES	
ISSPEC CHEM, INC. (DEMO) 855	Phone Number		(555) 000-1234	
	Address	Address		
ICNO CAS COMPANY (DEMO) (I	City/County/State		OAKVILLE /Live Oak /TX	
	ZIP Code		76520	
	E-PLAN ID#		DF1001	
DISTILL PETROLEUM CORPORA	Emergency C	ontact Ir	nformation (Primary)	
	Name	A	ADAM GOOCH	
	Title	Sr	Manager	
	Phone	(555) 001-1234		
	24-Hr Phone	(5	55) 001-3456	

#### Emergency Contact Information (Secondary)

Name	DAVID HINGIS		
Title	PLANT OPERATOR		
Phone	(555) 001-5678		
24-Hr Phone	(555) 001-4678		

(Download facility data) (Show Detailed View) (Print)

#### **E-Plan**



	0	Chemical Ir	wentory Inf	ormation				
Chemical (Click for ER link)	G CAS#	Max. Qty.	UN/DOT#	NFPA Code & Diamond H F R Sil	MSDS	Profile	CHRIS	
Acetaldehyde	75070	0000000	1089	2 4 2	MSDS	Profile	CHRIS	
Aluminum chloride and hydrochloric acid	Facility M	Іар		Simple Detaile Drawin Googl	Map d Map ng Tool e Map n	sketch	able for th	nis address
Diethanolami	Building Map			Simple	Simple Building Plan Detailed Building Plan			
Guthion 3 Flowable	Response Plans and Data			Eacility Risk N Tier II	Facility Response Plan Risk Management Plan Tier II Form			
Hydrocyanic Acid	Response Resources			On-Sit Contra	On-Site Response Resources Contract Response Resources Link			Link
Hydrofluoric Acid	Sensitive Areas			Public	Public Health Sensitive Areas Link Environmentally Sensitive Areas Link			<u>_ink</u> as Link



# Katrina



### **FEMA Not On Alert**

Paul W. Taylor Sep 26, 2005

The state of emergency caused by back-to-back hurricanes in the Gulf Coast states was compounded by communications failures — including the conspicuous absence of a modern alerting system to provide warnings about the coming threats to cell phones, pagers, and Blackberry devices or other personal digital assistants.

The beleaguered Federal Emergency Management Agency (FEMA), blamed for the inadequate initial response to Katrina, has also delayed funding to a state-based pilot project to begin modernizing public alerts using widely adopted technologies.

### Response



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## You Were Warned...



MOST OF THE AREA WILL BE UNINHABITABLE FOR WEEKS... AT LEAST ONE HALF OF WELL CONSTRUCTED HOMES WILL HAVE ROOF AND WALL FAILURE. ALL GABLED ROOFS WILL FAIL ...

### ...SHORTAGES WILL MAKE HUMAN SUFFERING INCREDIBLE BY MODERN STANDARDS...

POWER OUTAGES WILL LAST FOR WEEKS... AS MOST POWER POLES WILL BE DOWN AND TRANSFORMERS DESTROYED LIVESTOCK LEFT EXPOSED TO THE WINDS WILL BE KILLED

# Coordination

FEMA	National Oceanic Atmospheric Administration	Environmental Protection		
State Govt	Department of Energy	Communications Commission		
	Department of Health and Human Services	Federal Deposit Insurance		
Coast Guard	Demonstrate of Henry and Huber	Corporation		
Customs and Border Protection	Department of Housing and Urban Development	Federal Energy Regulatory		
Immigration and Customs Enforcement	Department of the Interior	General Services Administration		
National Guard	Department of Justice	National Archives and Records		
Department of Defense	National Center for Missing and Exploited	Autimisuation		
Department of Assisulture	Children	Office of Personnel Management		
Department of Agriculture		Peace Corps		
Department of Commerce	Department of Labor			
Department of Education	Department of State	Social Security Administration		
Department of Education	Bepartment of otate	Small Business Administration		
Bureau of Industry and Security	Department of Transportation	Corporation for National and		
Economic Development Administration	Department of Treasury	Community Service		
National Institute of Standards	Office of The Comptroller of the Currency	U.S. Postal Service		
and Technology	Department of Veterans Affairs	American Red Cross		



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# **Severe Weather**



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- Source of data for fusion and "situational awareness"
- Want to capture and model the semantics and structure formally
  - Express the decision making points
  - Stakeholders can use for their roles
  - May (Should) trigger other actions
- Requires major influence on the standardisation of such information
  - across agencies
  - standards bodies

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Na	ite Map	News	Organization	Search Enter Search Here		
Nation Tro Ite Map		Hurricane KATRINA				
ZCZ TTA BUL HUR NWS 10 1	ZCZC M TTAAOO BULLE: HURRIC NWS TI 4 PM C POT	MIATCPAT2 ALL 0 KNHC DDHHMM TIN CANE KATRINA PC/NATIONAL H CDT SUN AUG 2 TENTIALLY CAT ERN GULF COAS	ADVISORY NUMBER 24 URRICANE CENTER MI 8 2005 ASTROPHIC HURRICAN T	4 AMI FL E KATRINA HEADED FOR THE		
COAS AT NOR:	A HUR FROM I BORDEI PREPAI EVENII	RICANE WARNIN MORGAN CITY L RINCLUDING RATIONS TO PR NG.	G IS IN EFFECT FOR OUISIANA EASTWARD ' THE CITY OF NEW OF OTECT LIFE AND PROD	THE NORTH CENTRAL GULF COAST TO THE ALABAMA/FLORIDA RLEANS AND LAKE PONTCHARTRAIN. PERTY SHOULD BE COMPLETED THIS		

#### **Severe Weather Advisories Model**



### Summary



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- Incident notifications play a critical role in prediction, response, and recovery for emergency/disaster events
- Research needed into modeling and representation of such information
  - drive sharing of information
  - drive better decision support
  - drive standardisation
- Better Coordination
  - interoperability across agencies and jurisdictions