Satellite Services and Critical Infrastructures

Antonio Saitto

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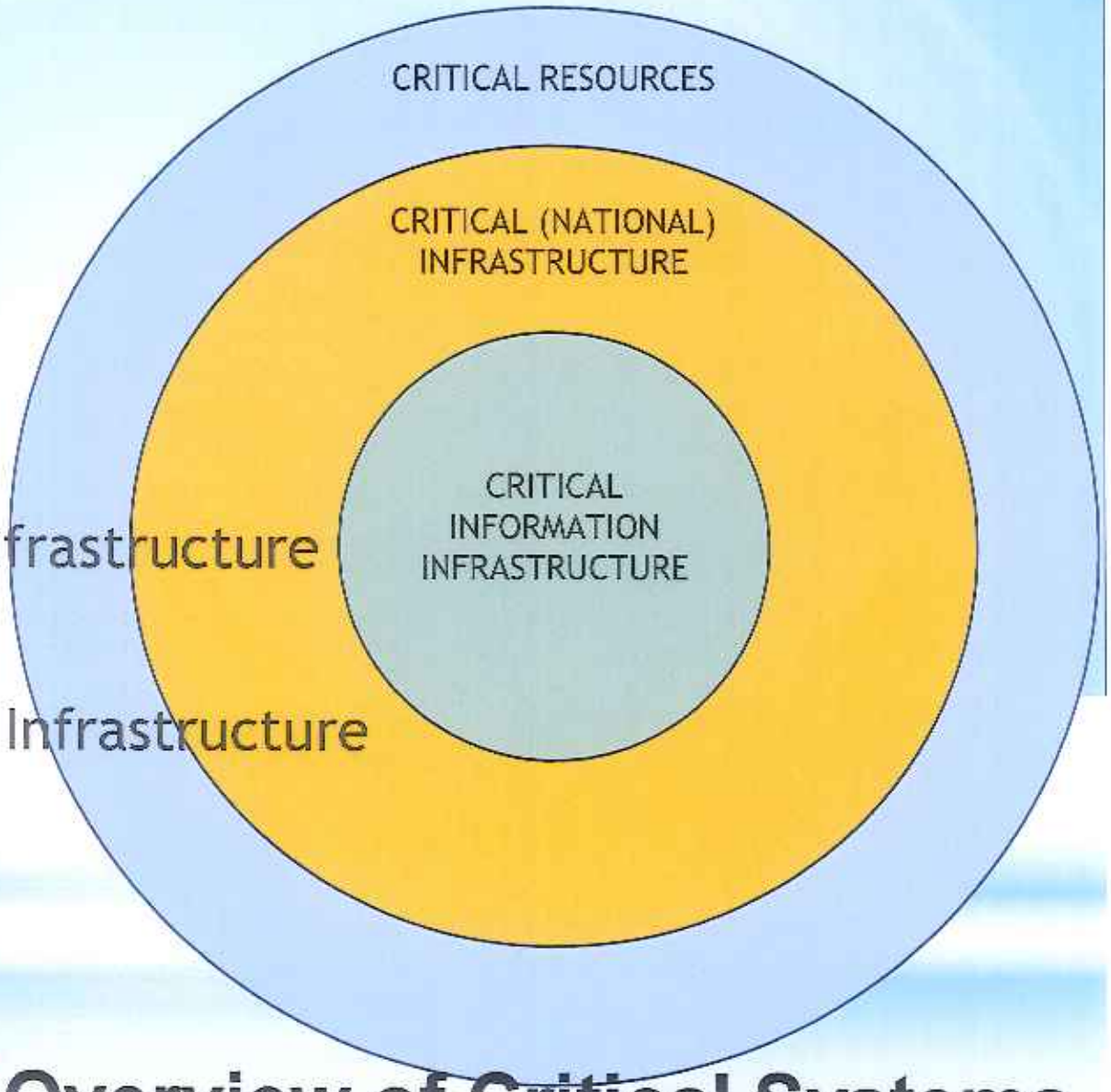
- The events after September 11th in the last decade have confirmed the absolute need to give *Homeland Security* and the *protection of Critical Infrastructures* the maximum attention and priority among the investment plans of the majority of western Countries
- The proposal come out from the above has generated a new level of integration among different systems and technologies, creating new solutions with a strong market potentiality, introducing new families of Dual Use Solutions.
- *Homeland security investments* result socially acceptable, considering also the meaningful spin-off into Safety solutions.

*Introduction

About Homeland Security



* Critical Resources
* Critical (national) Infrastructure
* Critical Information Infrastructure

* Overview of Critical Systems

* Most expansive of all the terms. Includes those assets within the sphere of critical infrastructure and critical information infrastructure
* Has been defined by some national governments to include
  * natural and environmental resources such agriculture, energy, freshwater, rainforests, etc.
  * national monuments and icons which have been defined as a physical structure or object recognized both nationally and internationally as representing a nation's heritage, traditions and/or values.

* Critical Resources

- Primarily defined in the context of
  - the adequacy of a nation's public works, e.g. bridges, roads, airports, dams, etc.
  - includes telecommunications, in particular major national and international switches and connections.
- Many countries, in defining critical infrastructure, include in the definition a reference to that nation
- Satellites themselves are a Critical Infrastructure
- Many other countries have specifically included the national component in the term itself (e.g. UK)

Critical Infrastructure

Critical Infrastructure : Examples from Member States

Australia	those physical facilities, supply chains, information technologies and communication networks which, if destroyed, degraded or rendered unavailable for an extended period, would significantly impact on the social or economic well-being of the nation, or affect Australia's ability to conduct national defense and ensure national security.
Canada	Critical infrastructure refers to processes, systems, facilities, technologies, networks, assets and services essential to the health, safety, security or economic well-being of Canadians and the effective functioning of government. Critical infrastructure can be stand-alone or interconnected and interdependent within and across provinces, territories and national borders. Disruptions of critical infrastructure could result in catastrophic loss of life, adverse economic effects and significant harm to public confidence.
European Union	'critical infrastructure' means an asset, system or part thereof located in Member States which is essential for the maintenance of vital societal functions, health, safety, security, economic or social well-being of people, and the disruption or destruction of which would have a significant impact in a Member State as a result of the failure to maintain those functions

* Critical Infrastructure : Examples from Member States

United Kingdom	"The [Critical National Infrastructure] comprises those assets, services and systems that support the economic, political and social life of the UK whose importance is such that loss could: 1) cause large-scale loss of life; 2) have a serious impact on the national economy; 3) have other grave social consequences for the community; or 3) be of immediate concern to the national government."
United States	systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters.

* Increasing reliance on IP-based and other networks as an ubiquitous aspect of social and economic activities of nations
  * a fundamental component in the design and operation of all forms of "traditional" critical infrastructure (e.g. electricity grids, transportation systems, water supply etc.)
* Therefore, some have proposed the introduction of a new term, **Critical Information Infrastructure.**

In Germany, the majority of information infrastructures are run by private companies. Hence, protecting these infrastructures is primarily the task of private operators and service providers. However, given the dramatic consequences damage to those infrastructures might have for the state, the economy and large parts of the population, sole responsibilities of individual operators is neither sufficient nor appropriate. ***This holds true also for critical infrastructures in Germany*.***

* Critical Information Infrastructure

*Germany's Federal Ministry of the Interior in a 17 June 2009 report entitled National Strategy for Critical Infrastructure Protection

Critical Internet Resources

* With emergence of a global information society, the term "**Critical Internet Resources**" is considered by many (e.g. CoE (**Council of Europe**)) as related to critical information infrastructure in the Internet era.
  - Subject of intense discussions at WSIS (**World Summit on the Information Society**) and other international fora
* No consensus yet on the proper scope of these resources
* general agreement on IP addresses, domain names, and root servers
* More expansive view (e.g. CoE): includes backbone infrastructure and IXPs; broadband access
* Some argue that considering the dynamic nature of the internet, there should be *no rigid definitions and specifically enumerated lists?*
* e.g. deployment of DNSSEC (**Domain Name System Security Extensions**) key signing keys in 2010

* E.g. telecommunication infrastructure and number portability
  * In many jurisdictions, it is not clear who "owns" the telephone number, that is, who has what rights over the number (e.g. can somebody sell or rent the number?).
* Similar issue is being faced by many countries on some Internet resources:
  * whether Internet names and addresses constitute an intangible property, or if it is a mere service which registrants enter into a contractual relationship with the provider

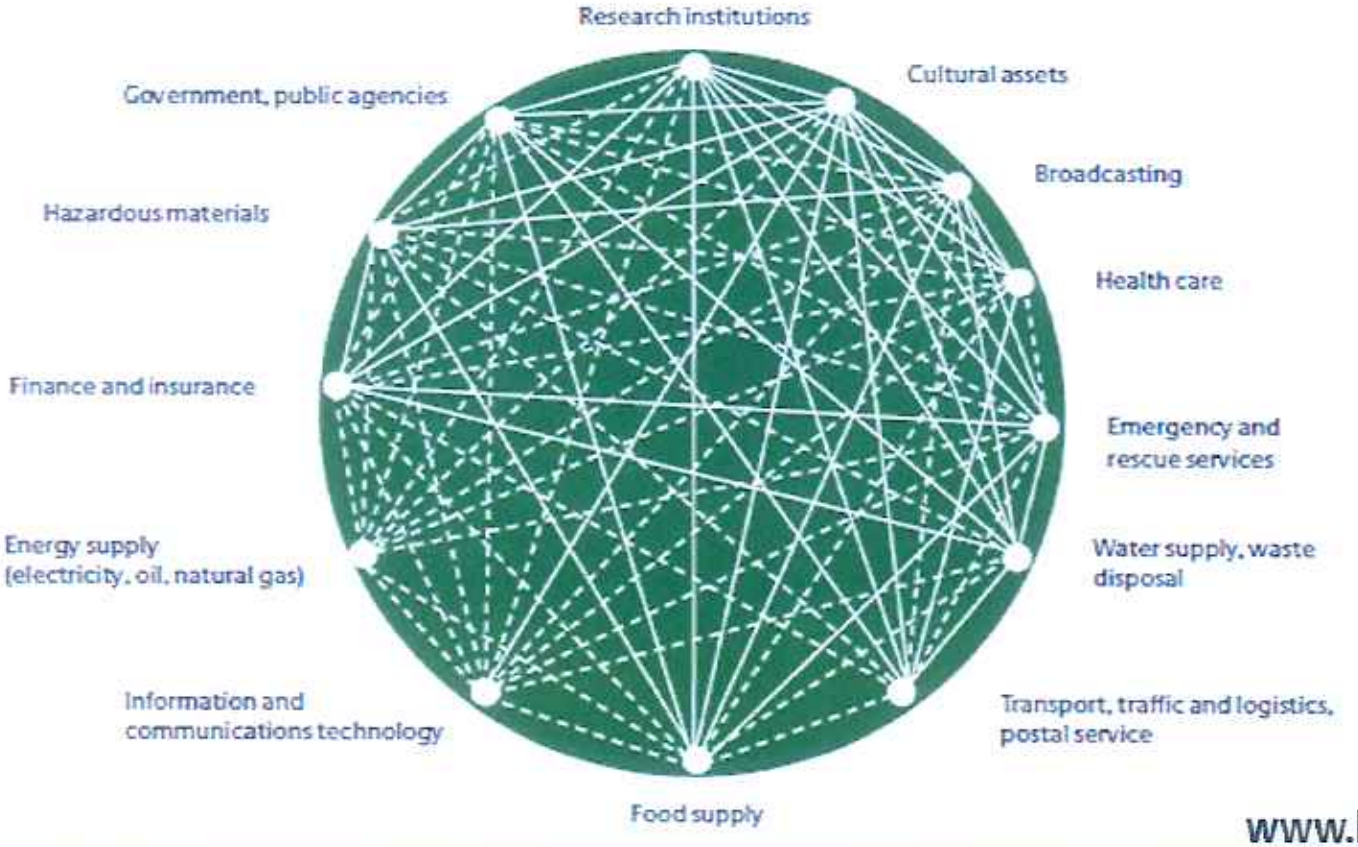
* Critical Information Infrastructure as *intangible assets*

"Security is a precondition of development."

European Security Strategy
December 2003

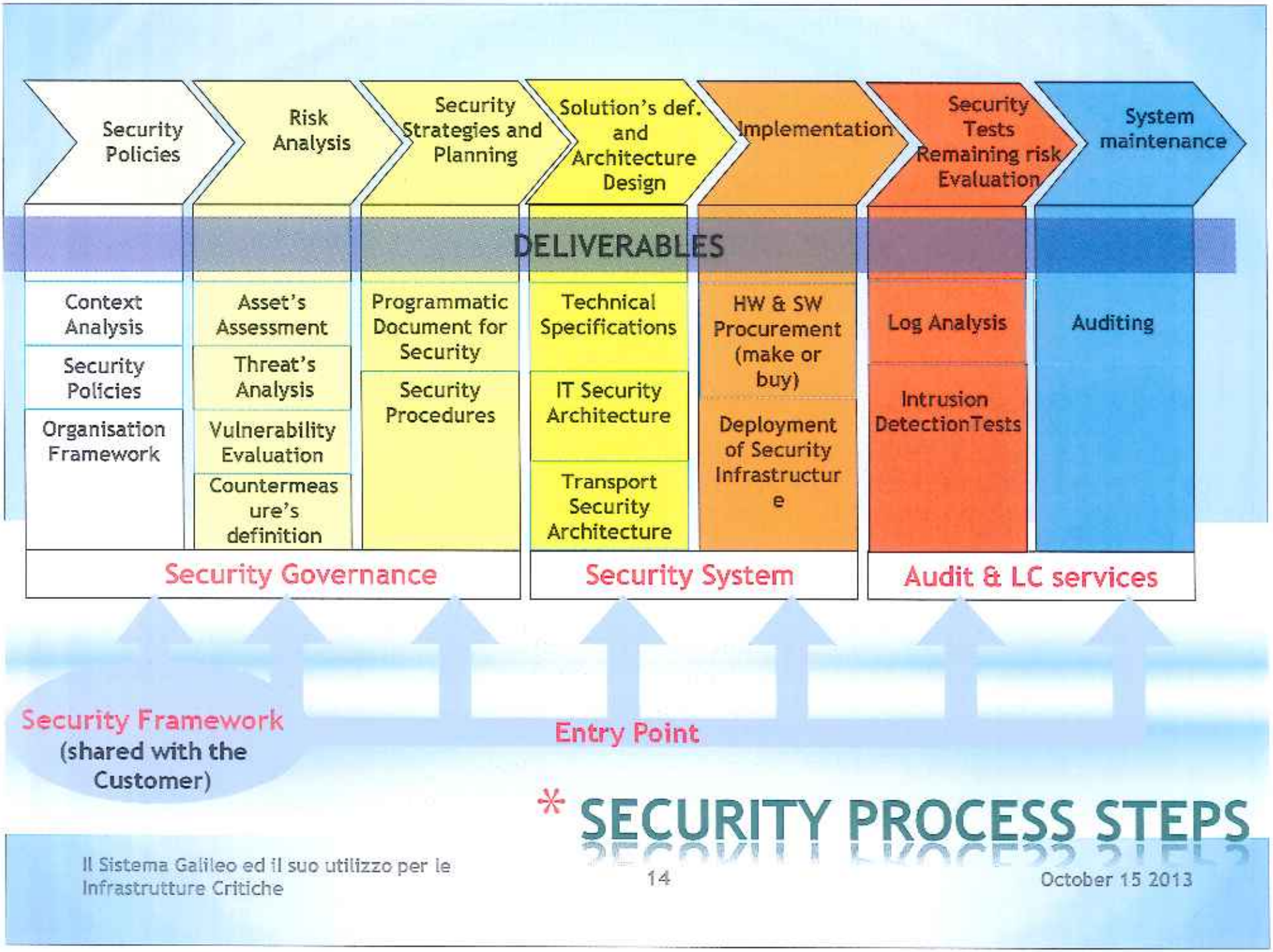
- Terrorism
- Illegal Trafficking
- Mass Migration
- Proliferation of Weapons of Mass Destruction
- Regional Crisis & Conflicts
- Illegal activities

* Security Threats

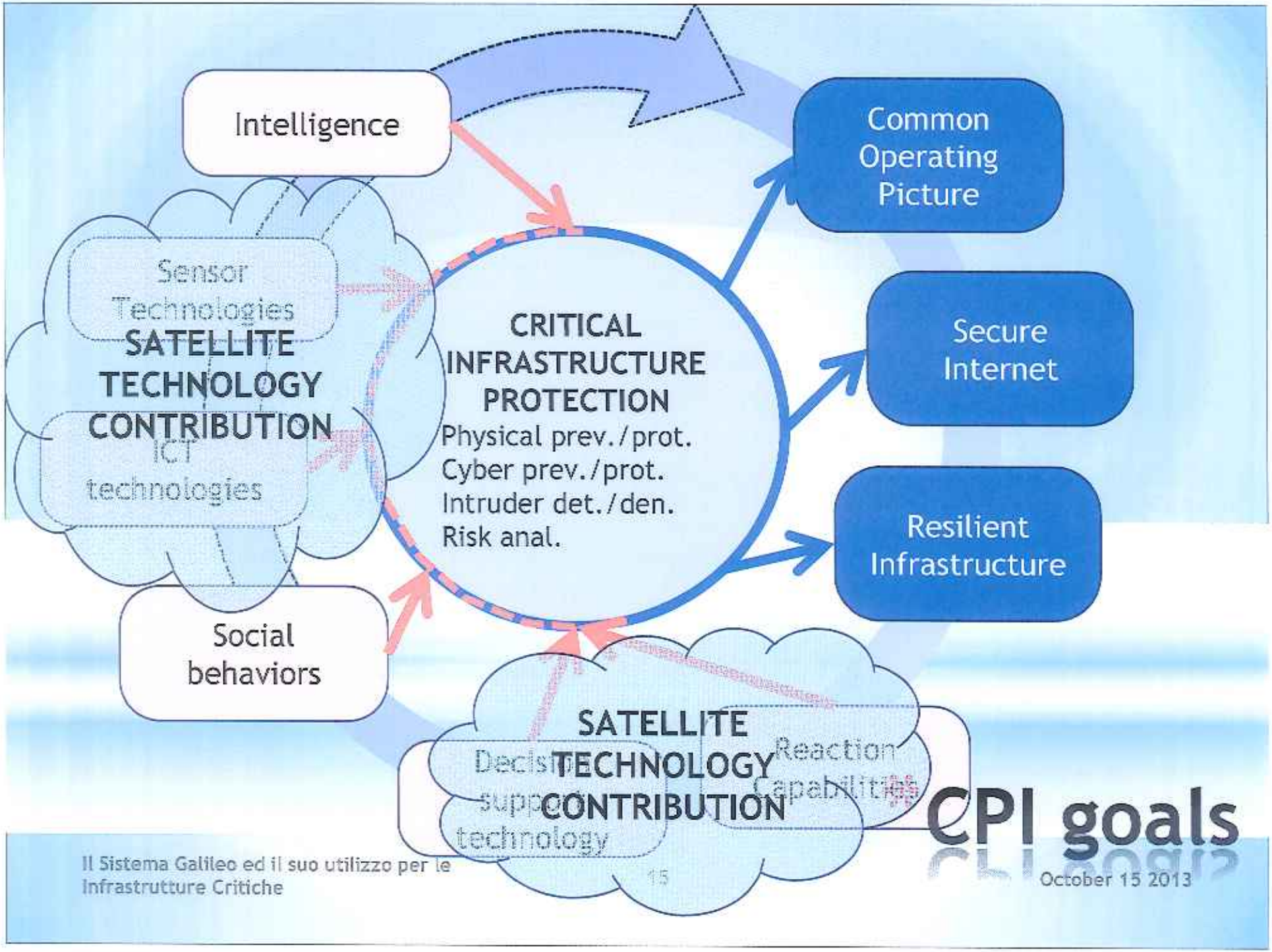


www.bmi.bund.de

* Critical Infrastructures in a broad sense



* SECURITY PROCESS STEPS


Intelligence
Sensor Technologies
SATELLITE TECHNOLOGY CONTRIBUTION
ICT technologies
Social behaviors
CRITICAL INFRASTRUCTURE PROTECTION
Physical prev./prot.
Cyber prev./prot.
Intruder det./den.
Risk anal.
Common Operating Picture
Secure Internet
Resilient Infrastructure
SATELLITE TECHNOLOGY CONTRIBUTION
Reaction Capabilities
technology

CPI goals

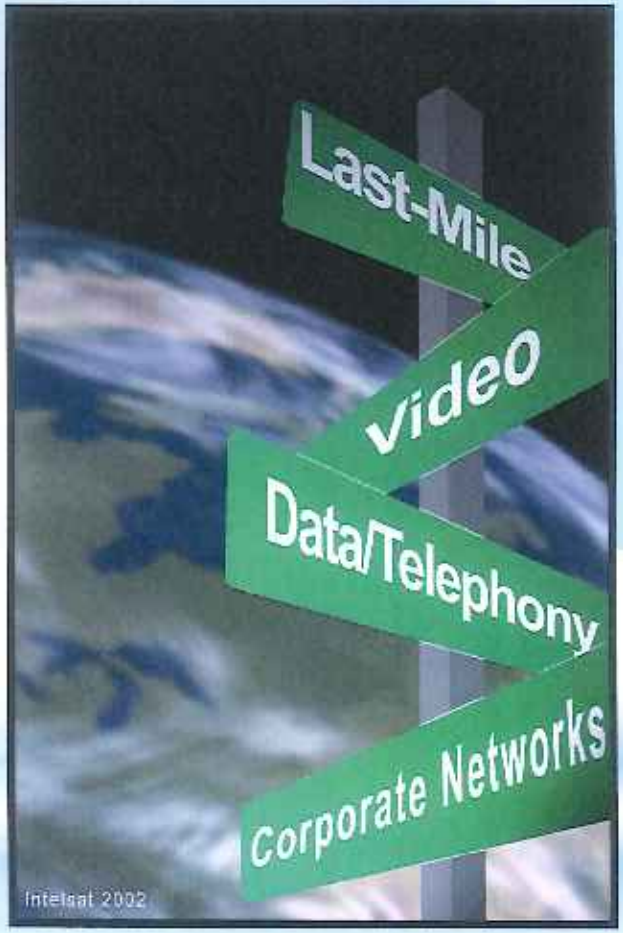
*Satellite Systems for Security

Satellite typologies

- Fixed Satellite Services
- Mobile Satellite Services
- GNSS (Global Navigation Satellite system) GPS, Galileo, Glonass, Regional Systems
- Remote Sensing
- Ground Infrastructures
- Ancillary Infrastructures

Fixed Satellite Services

- Data/Telephony Communications
- Internet Trunking
- Internet Backbone Connectivity
- Video Services/DBS/DTH
- Corporate Network Services
- Connecting "Unfibered"/Low Teledensity Locations
- Cable Distribution/ Restoration/ Redundancy



* Fixed Satellite Services

* INTELSAT
* PANAMSAT
* SES AMERICOM
* LORAL GLOBAL ALLIANCE
* HUGHES NETWORK SYSTEMS
* NEW SKIES SATELLITES
* EUTELSAT
* SES ASTRA

Mobile Satellite Services

- Anytime, anywhere telecom critical to homeland security
- Most reliable service for first response disaster recovery
- Remote data telemetry monitors US infrastructure
  - Utilities -oil/gas/water pipelines, electrical distribution
  - Trains/trucks - location/status monitoring
- Remote telephony key to infrastructure safety
  - Repair/maintenance of dams, bridges
  - Fiber restoration
- Maritime/Aeronautical communication
  - Lifeline for ships/planes
  - Emergency communications
  - Tracking dangerous shipments
  - Broadband commercial and government services

Mobile Satellite Services

* Globalstar

* Mobile Satellite Ventures

* Iridium

IRIDIUM

* ICO Global Telecommunications

* Connexion by Boeing

* Inmarsat

Other Mobile Satellite Services

* ACES
* Thuraya

Global Navigationg Satellite System

- GNSS is central to the lives of millions of civil and commercial users
  - Public safety dispatch - improves response time
  - Search and Rescue - locates emergency calls
  - Air Traffic Control - guides planes in all weather
  - Telecommunications - primary timing source,
  - Transportation - tracks trains, trucks, vital shipments
- Military and PRS services
  - Precision Munitions
  - Cruise Missiles
  - Unmanned Aerial Vehicles
  - Emergency Operations

* Remote Sensing

* Provides scientific, industrial, civil, military and individual users with high-resolution images for:
  * natural resource monitoring
  * urban and utility/telecom planning
  * agricultural assessments
  * insurance and risk management
  * oil and gas exploration
  * mapping
  * natural disaster/emergency response
  * national/regional security

* Sub Meter commercial imagery

Satellite for Economics

- Backbone of national TV, radio, and print media distribution
- Billions of data, credit, banking transactions daily
- Allows decentralized telecommunications and document storage for a variety of financial institutions and global trading operations
- Broadly used for inventory management, point of sale data collection, credit-card validation and e-mail delivery.

Satellite for Broadcast Industry

- Newsgathering - First choice for live coverage, providing high-bandwidth video links from remote locations to capture "breaking news"

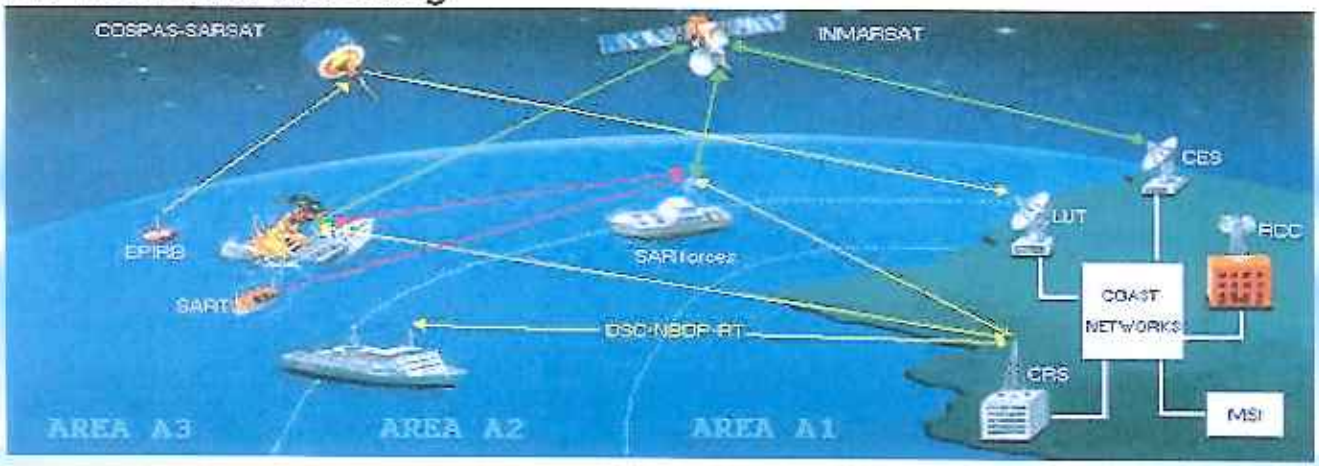
- Program Delivery - Primary feeds for network TV and radio broadcasts to affiliates and cable TV head-ends

Satellite for Homeland Security

- Not subject to physical damage that terrestrial networks are exposed to
- Lifeline for emergency workers, first responders, government and military planners
- News organizations rely on satellite phones and satellite trucks to report from the scene
- Enable data telemetry which monitors infrastructure in remote areas
- Public safety dispatch - improves response time by locating emergency calls
- Primary information source

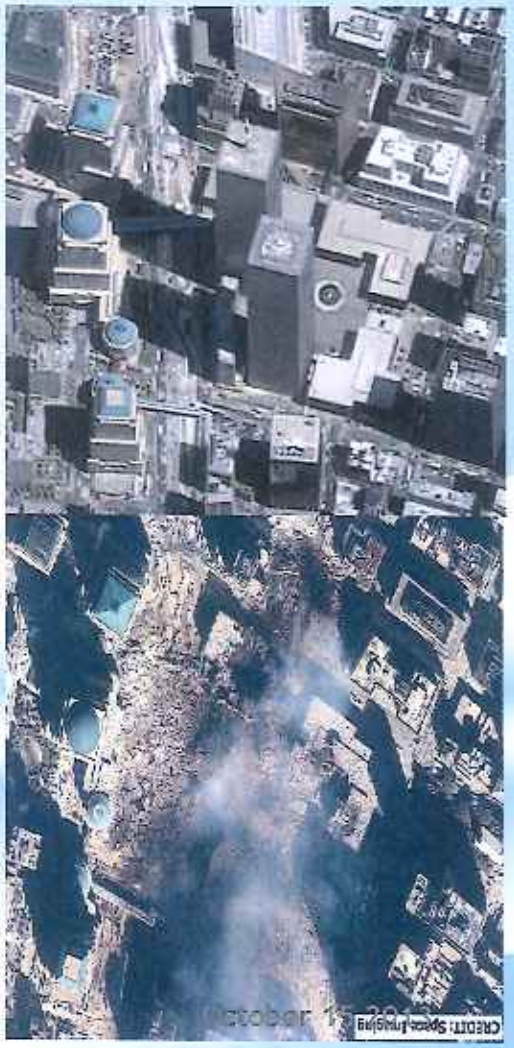
Search & Rescue by Satellite

- Thousands of lives saved in COSPAS/SARSAT program
- Transponders in ships, planes, other locations
- Ships rely on Global Maritime Distress and Safety System; Medical emergencies, crew overboard and air evacuations; Vessel fires, mechanical failures
- Piracy and coordination of law enforcement
- Hazardous material tracking



Disaster Relief and Recovery

- Physical damage and enormous demand stressed terrestrial networks during attacks
  - Satellite phones became a lifeline for emergency workers, government and military planners
  - News organizations relied on satellite phones and satellite trucks to report from the scene
  - Satellite broadcasters



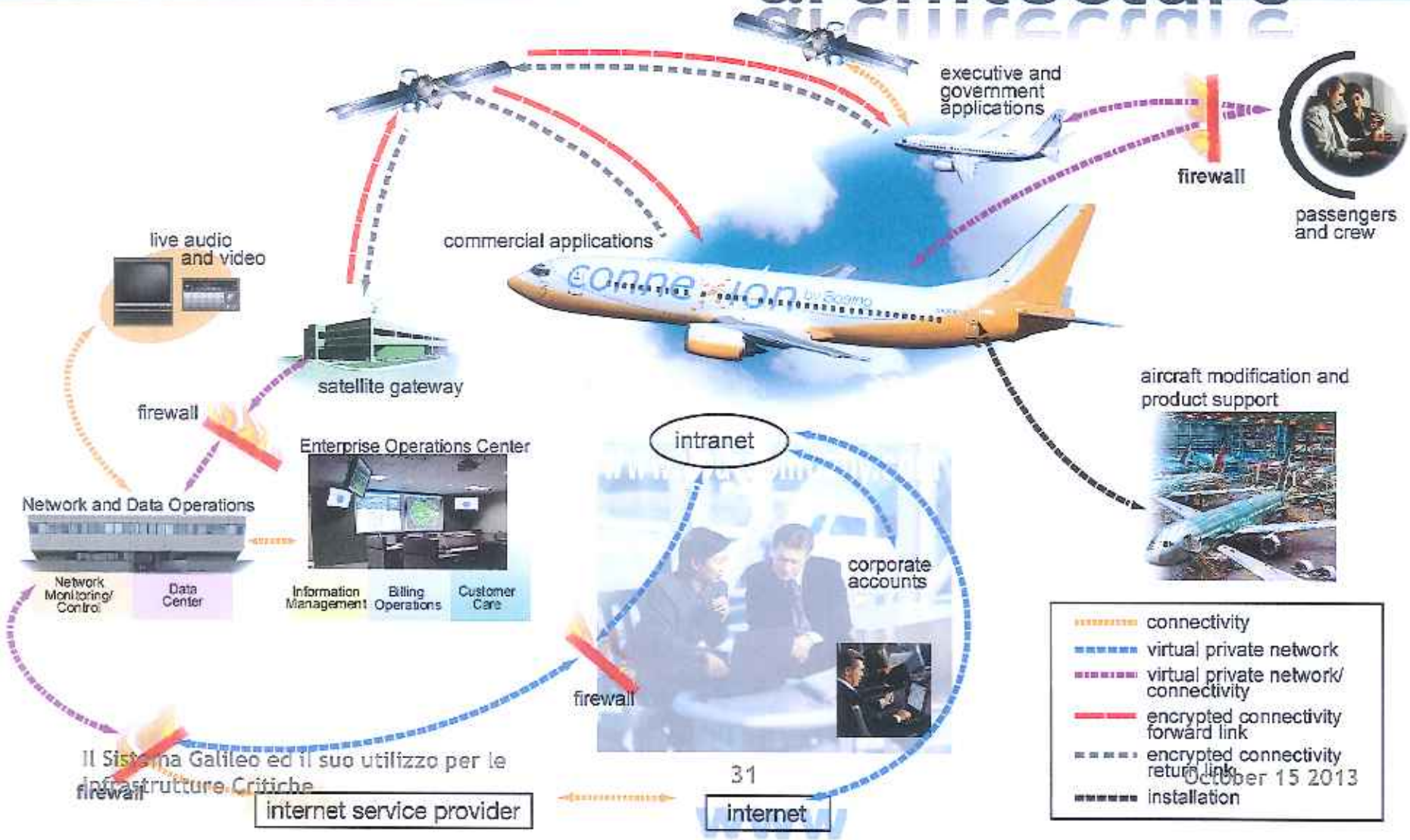
National Security

- Communications (Voice, Data, Television)
- Position, Navigation and Timing
- Early Warning, Tracking and Targeting
- Intelligence, Surveillance and Reconnaissance
- Technology, R&D, Experimentation
- Meteorological Observation

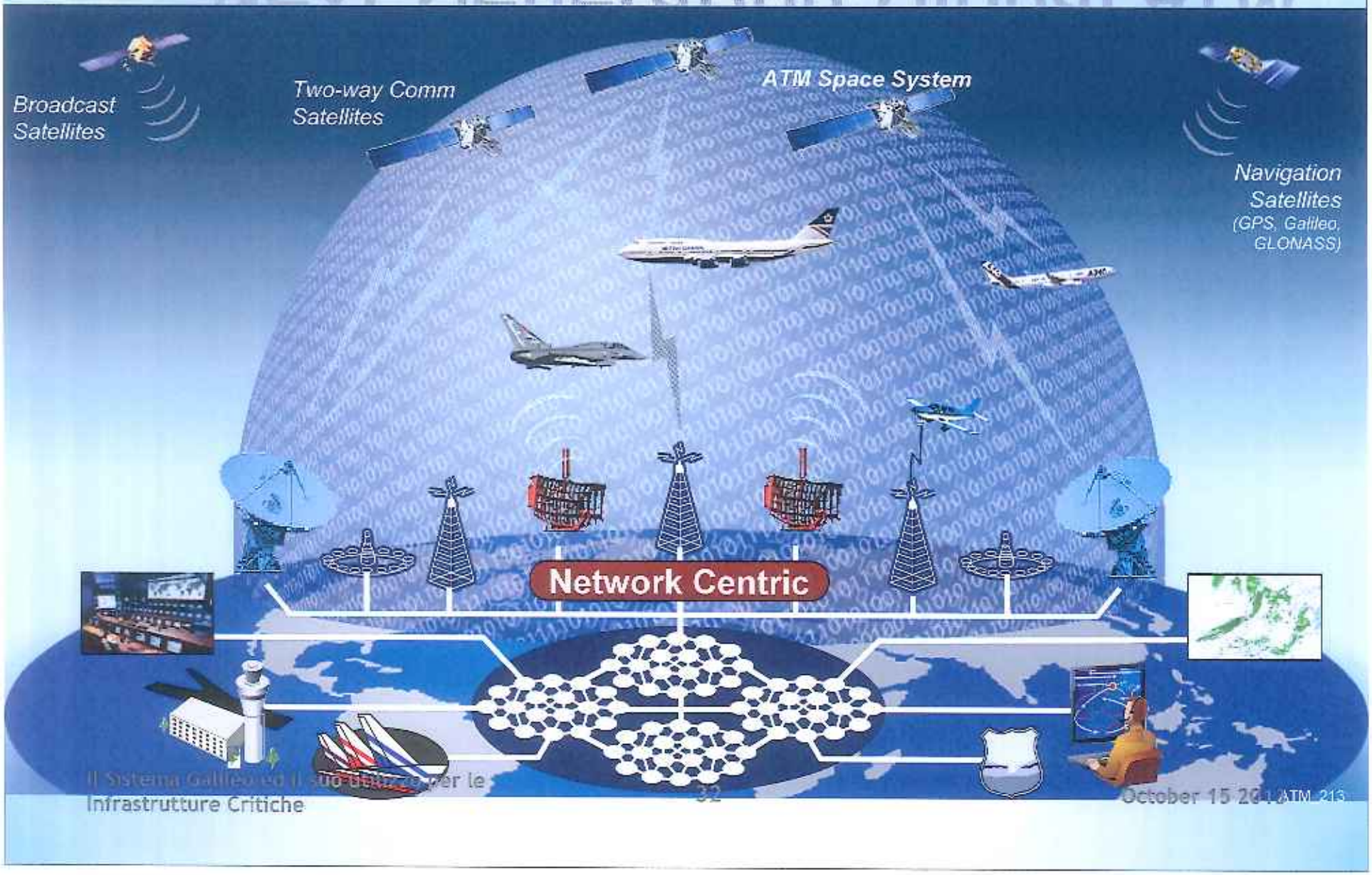
Future of Aviation

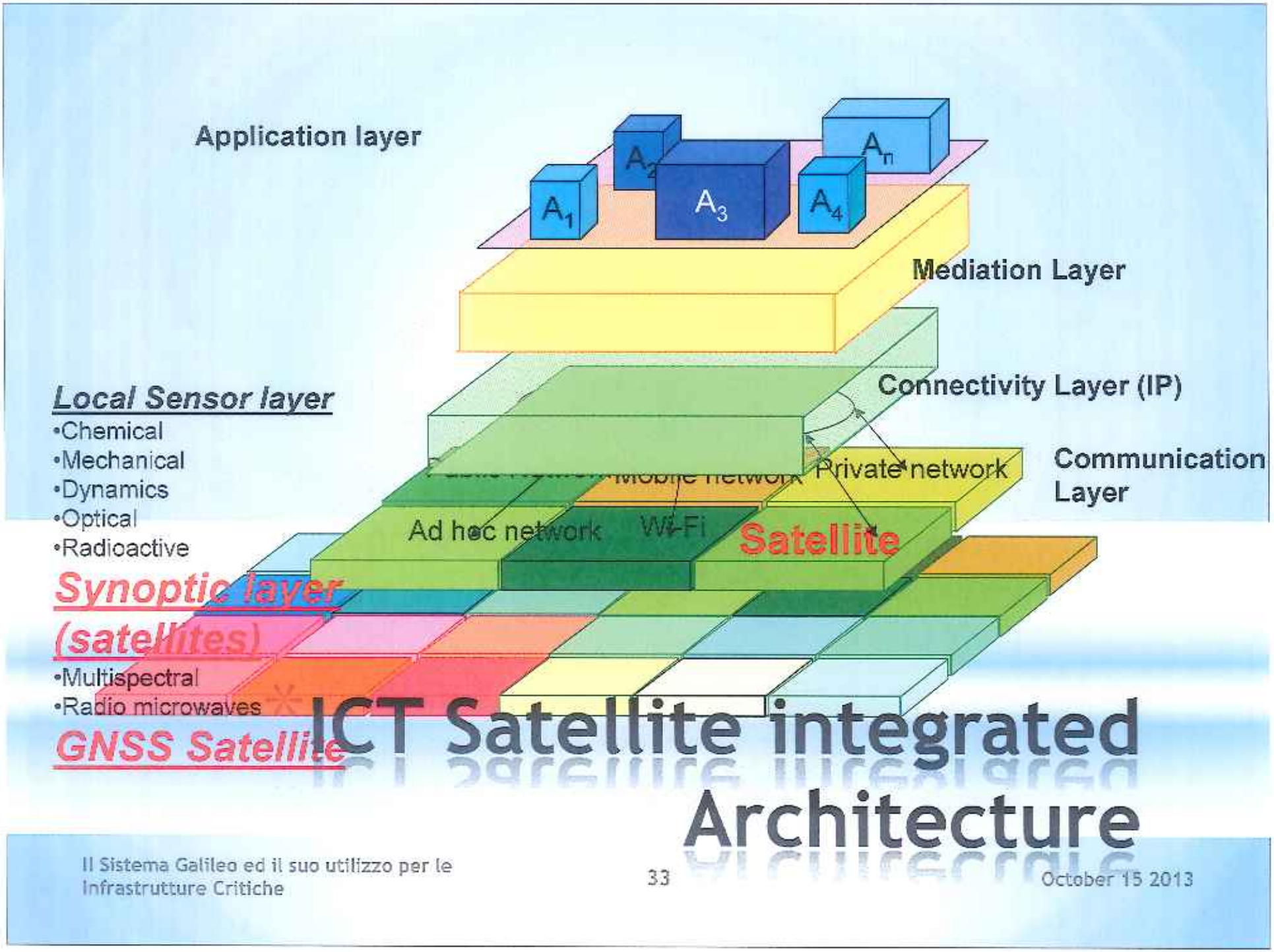
- Currently providing secure and reliable voice and data communications
  - In-flight data and voice communications for Crew, Air Marshals and passengers
  - Establishing specialized secure communications for airplanes, airports, seaports, and border control.
  - Enable Search and Rescue
- Next Generation Satellite Services
  - Global Air Traffic Management
  - Black Box Alternatives
  - Advanced passenger and safety services

General Areronautical architecture



Next Generation Global ATM




Application layer
A1
A2
A3
A4
An
Mediation Layer
Connectivity Layer (IP)
Communication Layer
Private network
Ad hoc network
Wi-Fi
Satellite
Local Sensor layer
•Chemical
•Mechanical
•Dynamics
•Optical
•Radioactive
Synoptic layer (satellites)
•Multispectral
•Radio microwaves
GNSS Satellite
ICT Satellite integrated Architecture

*GNSS satellite for Critical Infrastructures (examples)

Comparison among existing systems

SatNav Systems	Galileo	GPS	GLONASS
Satellite			
Operational capability	2011	1994 *(GPS III planned for 2012)*	1995
Constellation	30 satellites	27 satellites	24 satellites
Horizontal Accuracy	4 m (SoL DF)	< 13 m	57-70 m
Vertical Accuracy	8 m (SoL DF)	< 22 m	<70 m
Availability	99.5%		94% (Russia)
Integrity Risk	< $2x10^{-7}$ / 150sec	NA	NA
Time To Alert	6sec		
Continuity Risk	< $8x10^{-6}$ / 15sec		

- Galileo targets significant benefits to end users, in particular:
  - Improved positioning accuracy
  - Enhanced availability of navigation signals (more satellites, more signals)
  - System integrity features, i.e. the ability of the system to supply information on the dependability of the navigation information distributed

* Galileo services

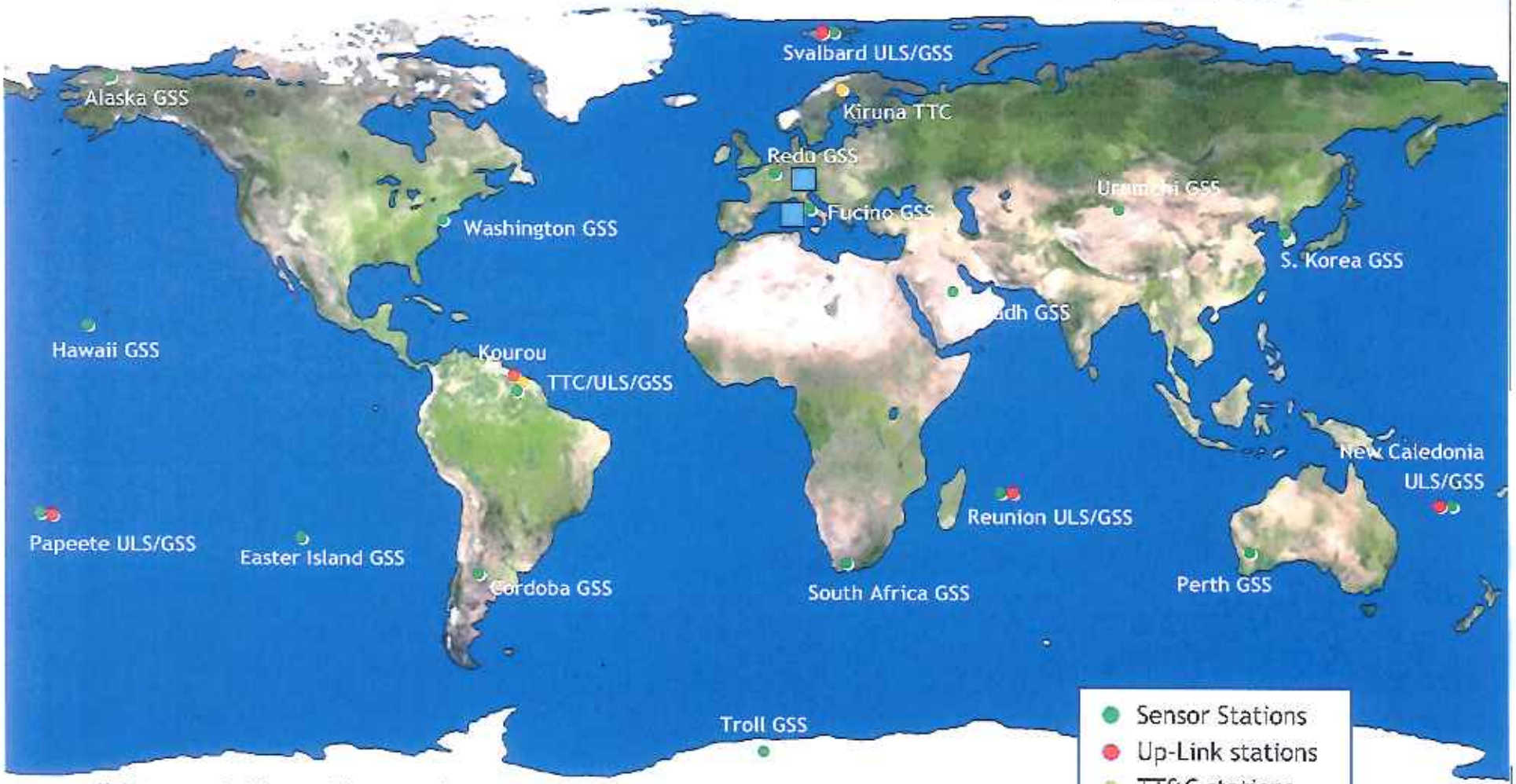
Navigation	Open Access	Free to air; Mass market; Simple positioning		Free of charge, no integrity information, no service guarantee
	Commercial	Encrypted; High accuracy; Guaranteed service		2 additional signals, payment of a fee
	Safety of Life	Open Service + Integrity and Authentication of signal		This service has to be certified by applying organisations (e.g. EuroControl for aviation)
	Public Regulated	Encrypted; Integrity; Continuous availability		Under European governmental control, available in times of crisis, accessible to authorised governmental users only
SAR	Search and Rescue	Near real-time; Precise; Return link feasible		global reception and handling of distress messages

Through its 5 services, Galileo is envisaged to serve both civil and governmental applications, bridging the gap between public safety, civil security and military markets

* Galileo Applications

Main Market Segments	Service	Related Applications
 Location Based Services	OS	Information & navigation services, Emergency Assistance, mobile payments
 Road	OS / CS	Route guidance, fleet management, real-time traffic information, electronic charging, emergency calls,
 Rail	OS / CS	Train signaling, traffic and asset management, track construction & survey, passenger comfort
 Maritime	OS / CS	Ocean & inland navigation, vessel traffic mgt, harbour operations, search & rescue operations,
 Professional	OS / CS	Precision agriculture, oil & gas exploration, fisheries, telecom network synchronization, bank & insurance
 Aviation	SoL	Assistance to ground operations, take-off, en-route flying and precision approach for increased safety
 Security	PRS	Law enforcement, boarder control, peace keeping, surveillance, emergency operations

*IOV Ground Segment Sites



* Satellite technology present itself as a formidable glue of different technologies
* The value added of satellites is in their flexibility and capability of adapting themselves to different scenarios
* In spite of common opinion satellite are more secure than terrestrial solutions in many cases, due to their architecture, the lightness of the terrestrial segment
* Due to their geometry is easier to detect jammers and to detect them, is easier to identify un-whished access and to apply service denial
* In summary satellite could be considered a confirmation that :

* **Security is a process not a product**


THANK YOU