

Objectives and added value of an Internet Key Figure System for Germany

S. Feld, T. Perrei, N. Pohlmann, M. Schupp

Institute for Internet Security, if(is)
Gelsenkirchen University of Applied Sciences
feld @ internet - sicherheit . de

Agenda

- Motivation
- Internet Key Figures
- Internet Germany
- Internet Key Figure System
- Summary

Agenda

- **Motivation**
- Internet Key Figures
- Internet Germany
- Internet Key Figure System
- Summary

Motivation (1/2)

Studying the Internet because

- Interesting complexity
- Critical infrastructure
- On-going operation is essential
 - economy, politics, citizen, ...

Global view*:

Active AS: 39,550

Sum of connections: 82,833

Lots of dependencies

- Technical dependencies
 - Autonomous Systems, connections, intercontinental undersea cable, ...
- Dependencies at the service level
 - DNS (essential for web surfing, but also misused by botnet's C&C server), BGP, ...
- Administrative dependencies
 - ICANN's management of TLDs, ...

Motivation (2/2)

Progression of technology

- Cloud technologies change the up-/downstream ratio
- Distribution of CDNs
- Spread of VoIP, HD video, ...
- → Increasing traffic

Necessity: A system, that can

- measure,
- evaluate and
- visualize the state of the Internet

Avg. data throughput at world's largest IXP	
12/2005:	50 Gbit/s
07/2010:	400 Gbit/s
01/2011:	900 Gbit/s
today:	1 Tbit/s

OK, so what do we measure?

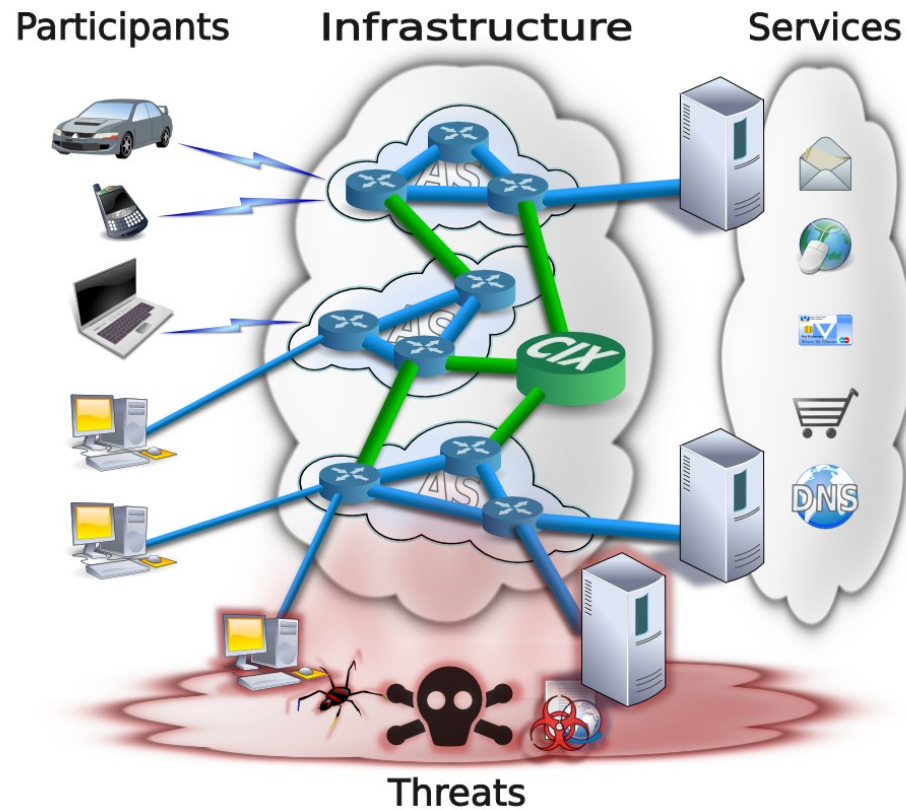
Agenda

- Motivation
- **Internet Key Figures**
- Internet Germany
- Internet Key Figure System
- Summary

Internet Key Figures (1/5)

Internet Model

- Dividing the complex research object “Internet” into four separate functional segments

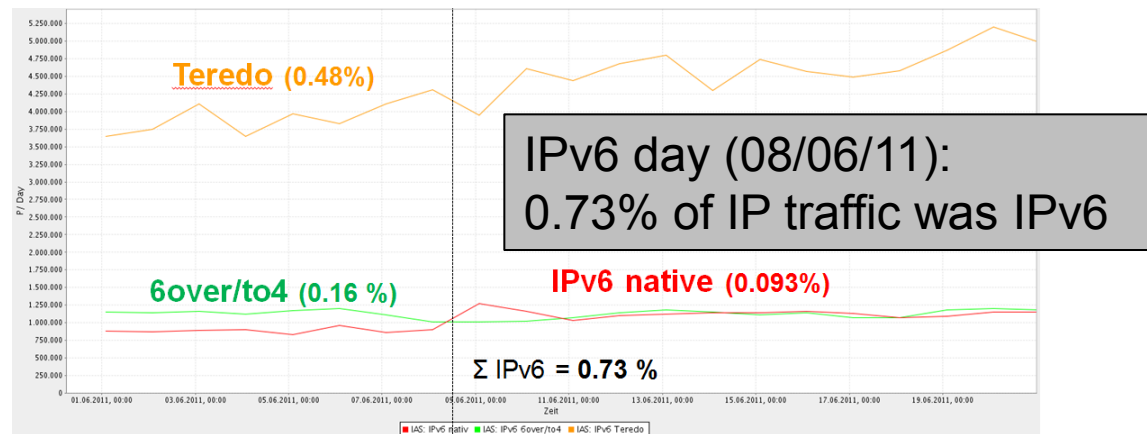
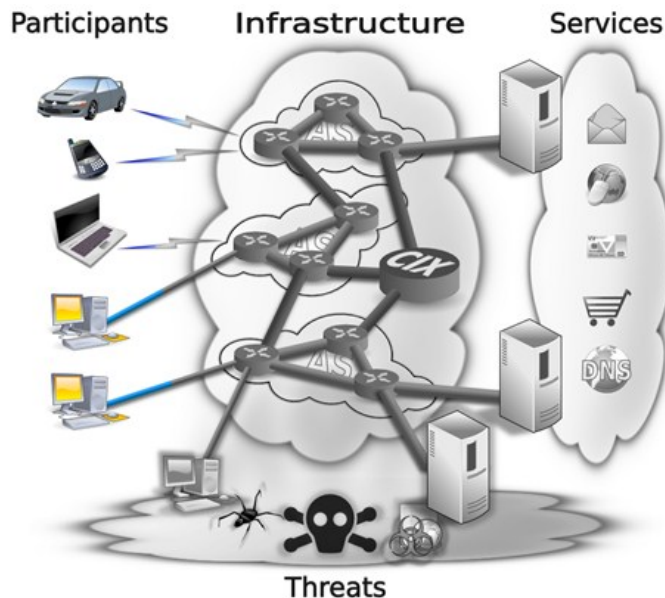


Internet Key Figures (2/5)

Usage Estimation (aspect participants)

- Various channels and devices to connect to the Internet
- Entirely new classes of devices by trends like home automation and smart grid

→ **Make statements about the utilisation of the Internet and the technologies used**

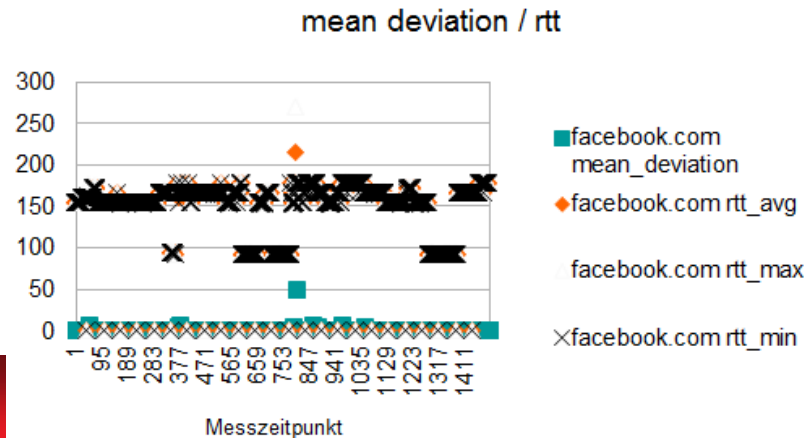
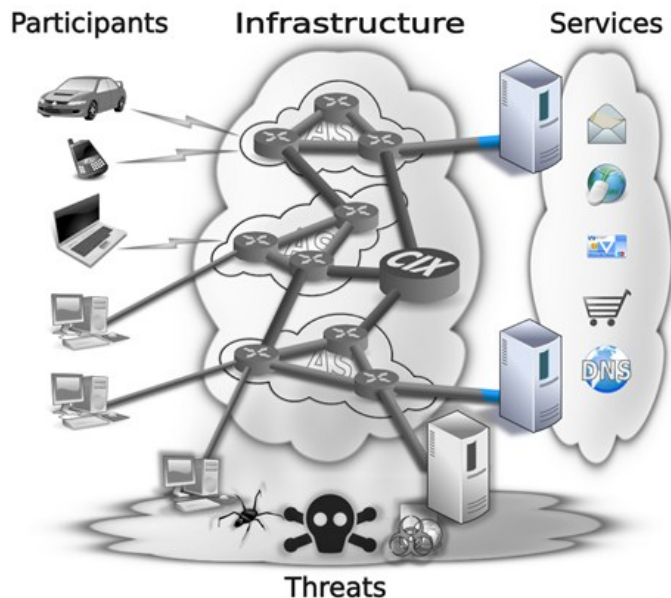


Internet Key Figures (3/5)

Availability (aspect services)

- The mere existence of a service says nothing about the real user experience
- Quality is determined by parameters such as bandwidth and response times

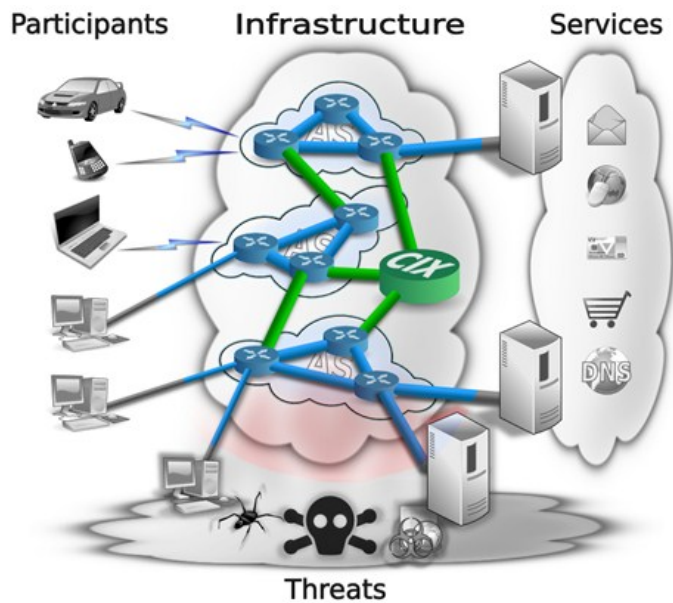
→ **Make statements regarding the availability of services on the Internet from the perspective of end users**



Internet Key Figures (4/5)

Capability (aspect infrastructure)

- The Internet consists of numerous, separately managed sub-networks (Autonomous Systems)
- Analyzing the mutual dependencies gives
 - Indication of possible bottlenecks and weaknesses
 - View on the future development of the infrastructure and the quality of supply



→ **Make statements about the capacity and dependencies of the Internet**

The largest German AS (DTAG)*:
Position 24 with 478 connections

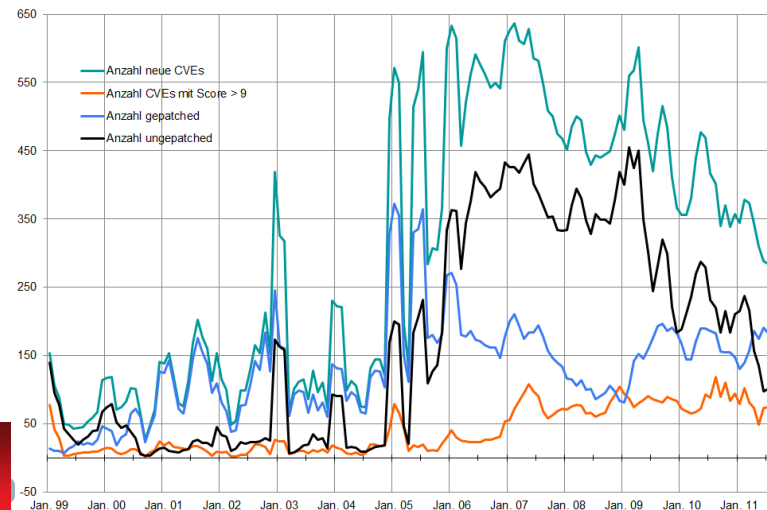
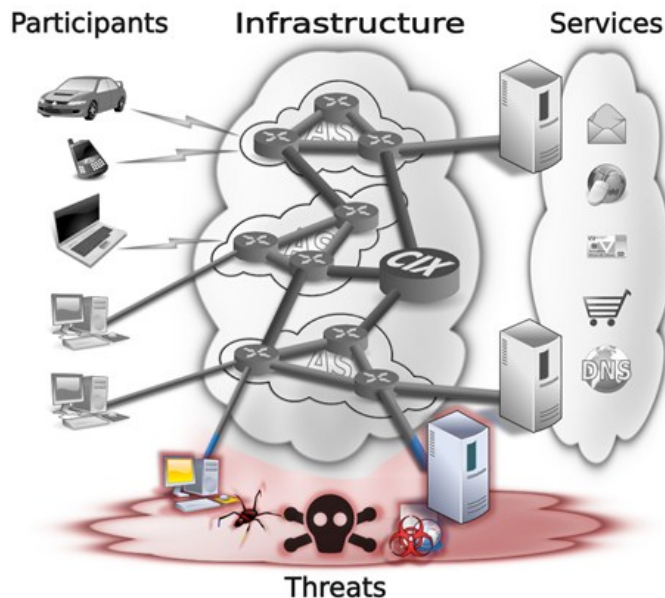
(1st: Cogent with 3,278 connections)

Internet Key Figures (5/5)

Threat potential (aspect threats)

- Malware and other malicious activity on the Internet are pervasive
- Previously limited to individual computers, today on a larger sphere (e.g. DDoS)

→ **Make statements about the threats of the Internet**



Agenda

- Motivation
- Internet Key Figures
- **Internet Germany**
- Internet Key Figure System
- Summary

Internet Germany (1/2)

Project “German Internet Index”

- Focusing on a particular part of the Internet
- Those Autonomous Systems that have a special role for Germany
- Making the key figures interpretable and comparable

Definition

- Every Autonomous System that uses IP addresses in Germany
- Mapping AS to IP address blocks via project Route View’s BGP routing table
- Mapping IP addresses to countries via Maxmind’s free GeoLite database

DE: 1,528 AS
GB: 1,804 AS
CZ: 350 AS

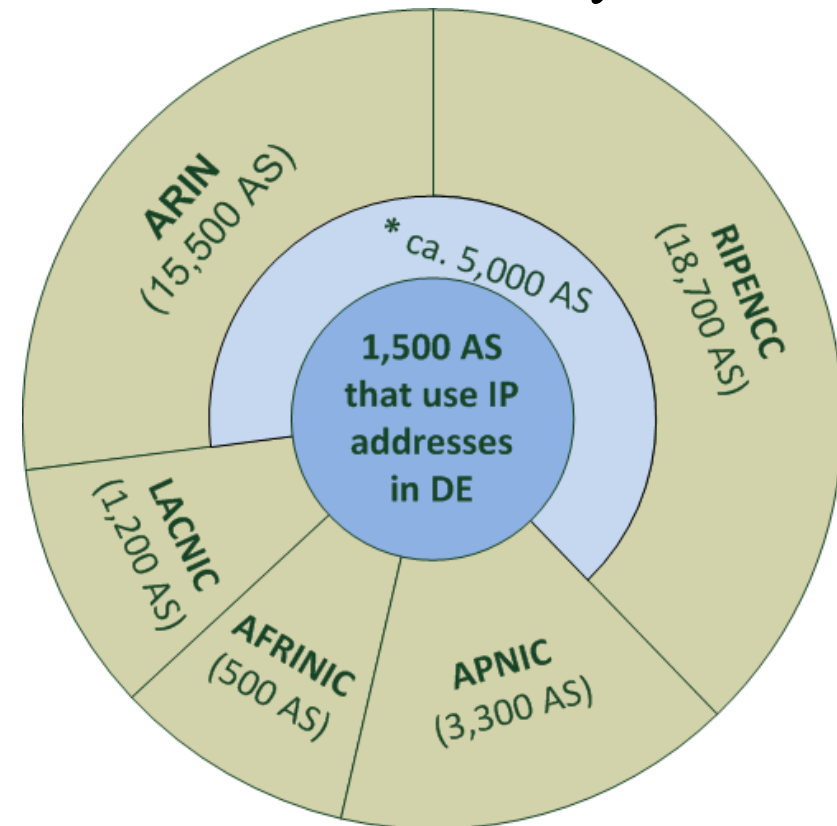
Internet Germany (2/2)

Extended AS area

- Some considerations need a broader definition
- Many content and transit provider relevant for Germany are located abroad

Definition

- All AS of Internet Germany
- Plus those AS, that are directly connected and meet the following criteria:
- AS is located in Europe (ripe-registered) or North America (arin-registered) and has a certain size (no business customers)



Agenda

- Motivation
- Internet Key Figures
- Internet Germany
- **Internet Key Figure System**
- Summary

Internet Key Figure System (1/5)

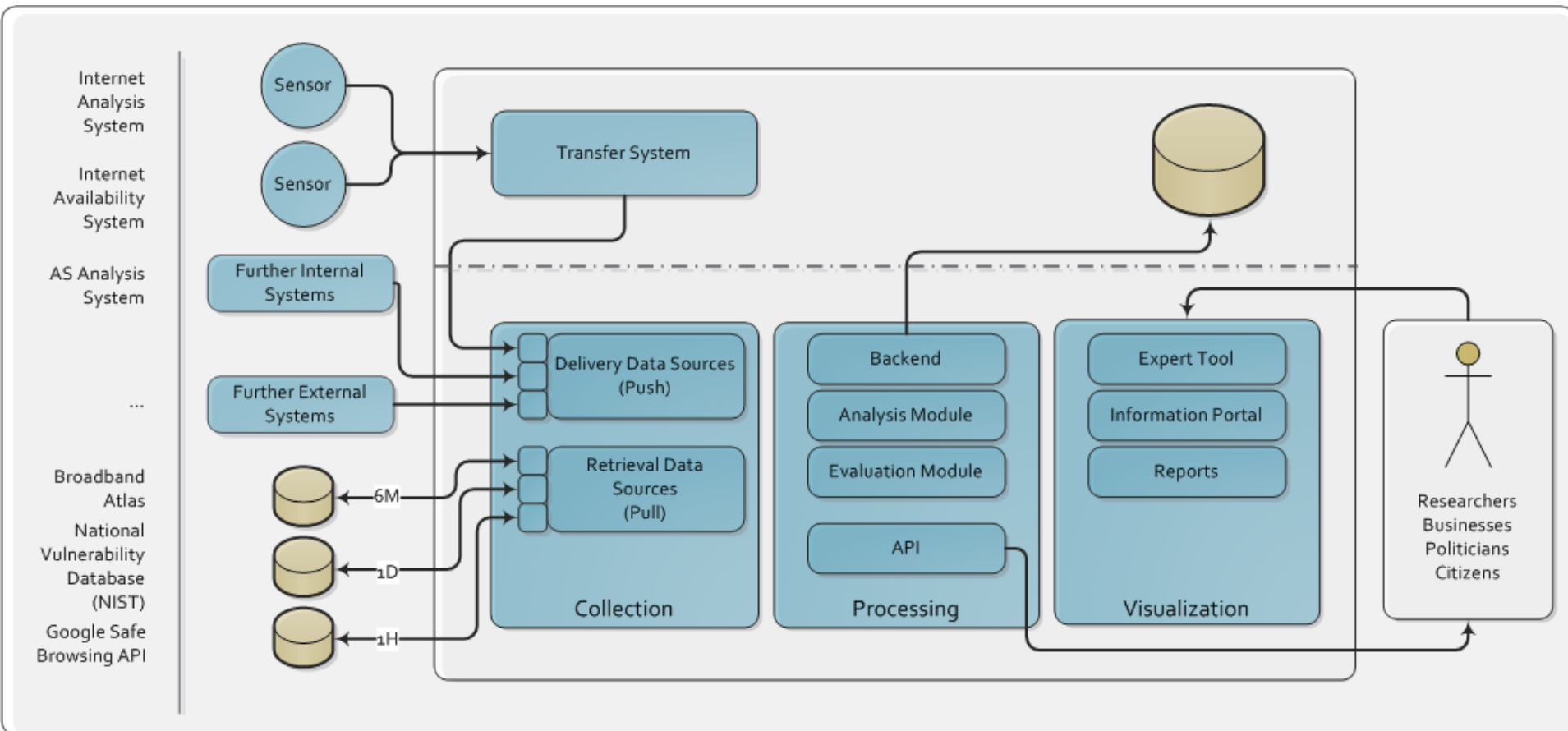
Approach to an Internet Key Figure System

- Collection of raw data from various sources
 - Processing to meaningful, practice-relevant metrics
 - Consistent presentation, comparability of results
- Very compact description of the situation in the respective area

Our Internet Key Figure System...

- basically consists of three components
 - data collection
 - data processing
 - data visualization
- is a source of information that can easily be adapted to individual needs

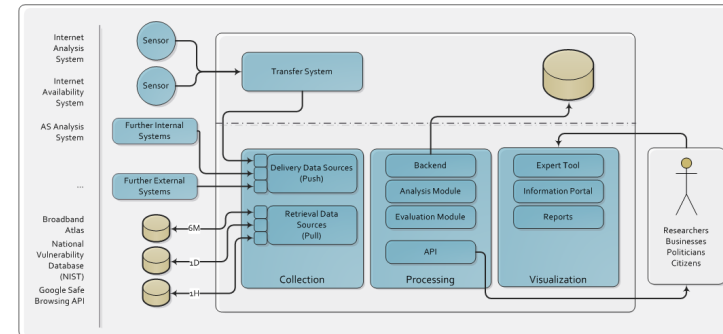
Internet Key Figure System (2/5)



Internet Key Figure System (3/5)

Data Collection

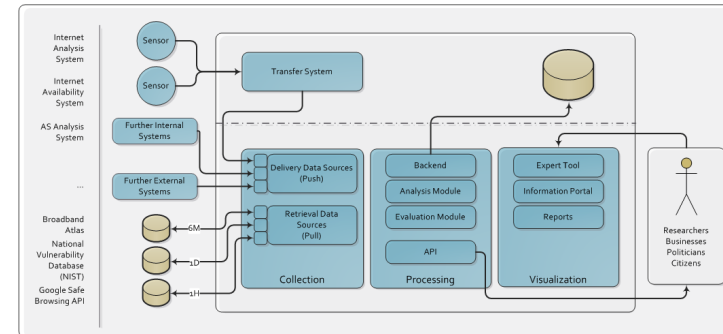
- Reads various data sources
 - Sent to the system by external sensors or systems
 - Requested by the system
- Collects data as general as possible
 - Due to the systems' explanatory power
- Modular architecture in order to easily incorporate data from partners
 - Internet Analysis System if(is)
 - Internet Availability System if(is)
 - National Vulnerability Database extern, pull
 - Broadband Atlas extern, push
 - ...



Internet Key Figure System (4/5)

Data Processing

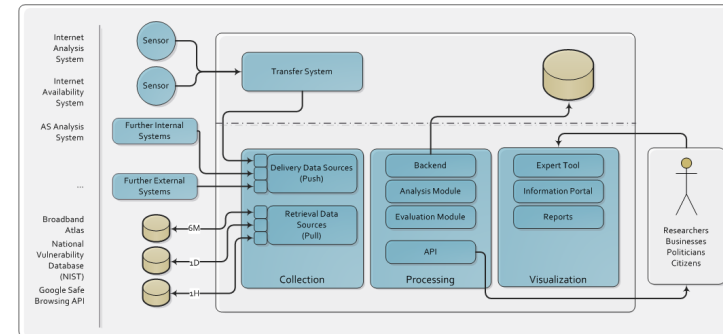
- Analyzing the current state of key figures
- Long-term run of the Internet Key Figure System
- Evaluating the future development of the key figures
 - Ensured by the efficient provision of historical data
- Emphasize different relationships between key figures
 - Logical, empirical, hierarchical relationships
 - Data Mining, Time Series Analysis, ...
- Possibility of retrospective analysis



Internet Key Figure System (5/5)

Data Visualization

- Easily check assumptions about connections between different key figures
- Selectively represent the data collected and merged
 - Researcher, businesses, politicians, citizens, ...
- Enable different views on the key figures via various tools
 - Expert tools for a detailed analysis
 - Information portal for an overview
 - Reporting functionalities



Agenda

- Motivation
- Internet Key Figures
- Internet Germany
- Internet Key Figure System
- **Summary**

Summary

Internet

- Complex system with lots of dependencies
- Critical infrastructure that needs to be protected

Internet Key Figure System

- Comprehensive information and analysis tool
- Contributes to the protection of the critical infrastructure by providing crucial data

Data Sources

- Implemented new tools, using institute's technologies
- Needing partner for several concrete information

Objectives and added value of an Internet Key Figure System for Germany

Any questions?

S. Feld, T. Perrei, N. Pohlmann, M. Schupp

Institute for Internet Security, if(is)
Gelsenkirchen University of Applied Sciences
feld @ internet - sicherheit . de